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# The American Association of Genito-Urinary Surgeons

## First Day, May 7, 1907

## DEFORMITIES OF THE PENIS DUE TO SYPHILIS, GONORRHŒA, AND OTHER CAUSES

By Robert W. Taylor, M. D., of New York

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PERMANENT deformities of the penis constitute an interesting and important class of cases concerning which there has been a want of knowledge and much doubt and uncertainty. In some of these cases syphilis in its various phases plays a leading part; in others there seems to be an occult symbiosis of lues and gonorrhœa. The latter infection is sometimes concerned in the development of elephantiasis of the penis, but it is probable that the gonococcus is only the starting point of the hyperplastic process, which is actively contributed to by a more persistent and potential micro-organism.

A number of cases of penile enlargement have been observed in which traumatic lesions of the penis (intra-urethral and extra-urethral) and of the juxtapudental parts have presumably been the active focus of hyperplasia. Such cases have been diagnosticated sporadic elephantiasis, which is simply a synonym for want of knowledge.

I purpose, in a terse manner, to consider all the foregoing morbid conditions, and to discuss and portray the up-to-date appearance of the various pathological changes developed in

this essay, a subject which, unfortunately, has secured little, if any, scientific attention.

In the primary and secondary stages of syphilis indurating œdema is sometimes seen to cause distortion of the organ and derangement of its function; in the tertiary stage ulceration and infiltrative lesions may also produce similar results.

### I. INDURATING ŒDEMA: CLINICAL HISTORY

Indurating œdema is observed in no other disease than syphilis. There are many facts concerning its varied conditions which are very interesting and worthy of study and exposition, by reason of their obscurity and of the fact that in many observed instances there was a want of knowledge on the part of medical men concerning them. Indurating œdema (œdema indurativum, Sigmund: *œdema scleroticum*, Pick) is mostly seen as a complication of hard chancre. When the initial lesion is fully formed and its induration well marked and circumscribed, a wall or circumvallation may develop around it. This hyperplastic process occurs slowly or moderately quickly, without any marked symptoms of pain, uneasiness, or discomfort. In one or two weeks the tumefaction around the chancre becomes well marked, and examination shows swelling and hardness, without pain, in the parts. In this aphlegmasic manner the induration extends and may involve the whole integument of the penis. If the chancre is seated at the end of the prepuce, the swelling gradually extends to the base of the organ; if on the balanopreputial sulcus it involves the prepuce, and then creeps up to the root; if in the middle of the integument, it spreads up and down. In most cases the hard œdema is limited to the penis, but it may extend up the abdominal walls and towards the groin, or it may more or less slowly creep down and involve the scrotum. In one of my cases of chancre of the scrotum the œdema quite promptly involved the whole organ, but was then checked by energetic treatment.

When the lesion is fully developed it presents an appearance which is very characteristic; it is *sui generis*. It has not the appearance of inflammatory engorgement, nor of ordinary acute or chronic œdema. The invaded tissues are smooth, tense, hard, and dense, like one's ear or unyielding like bone. There is no

PLATE I.—Presented by Dr. Robert W. Taylor.

FIG. 3, CASE III.—Indurating œdema of penis and scrotum.

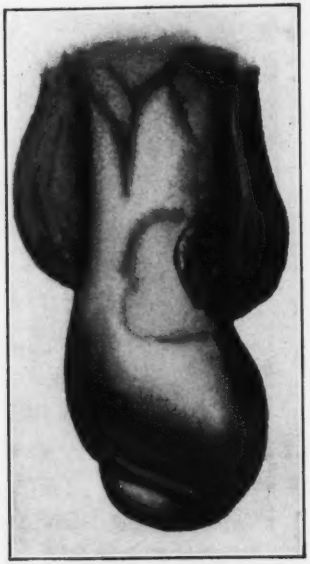


FIG. 2, CASE II.—Indurating œdema and hard chancre of penis.

FIG. 1, CASE I.—Indurating œdema and hard chancre of penis.

pitting on pressure, no pain, nor sensitiveness, simply an aphlegmasic condition. The color of the parts is of a dull brick red or of a purplish hue. When fully developed it may remain for months in its indolent course, of it may at times undergo peripheral extension. Three of my cases will clearly portray the objective appearances of this affection.

CASE 1. In Fig. 1 is shown a case of indurating œdema of the whole penis in a young man, twenty-two years old. The lesion began in a chancrous erosion seated on the end of the prepuce. It attained its development in about ten days and became typical in character. It was followed by general syphilis.

CASE 2. A young man, twenty-eight years old (Fig. 2), had a large chancre of raw beef appearance (chancrous erosion) on the middle of the cutaneous sheath of the penis, which became the focus of indurating œdema travelling downwards and upwards and involving the whole organ. The result was a penis which looked like the clapper of a bell. It is not at all unusual to see strange shapes produced by indurating œdema of the penis, like Indian clubs or gong handles.

CASE 3. The third case was one of especial interest (see Fig. 3). It was that of a man, forty-nine years old, who had a hard nodule on the penis. In eight weeks the penis and scrotum began to swell, and at the end of two weeks they had become so enormously swollen that he entered a hospital, where an attempt was made to relieve the phimosis by a dorsal incision of the prepuce. Subsequently the swelling was reduced slightly by the application of leeches to the penis. The true condition of the patient had not been recognized when he first came under my care at the Charity Hospital. At this time the swelling had existed for several weeks, and the patient was very anæmic. He was put to bed and given mercurials and tonics. The swollen scrotum was about as large as a cocoanut, and the penis correspondingly large. There was no succulence of the tissues; the prepuce was of a purplish color, and as hard as cartilage, and the phimotic condition was still present. Although the penis was involved in the swelling, the excessively hard œdema was in the prepuce. Circumcision was performed and the hardness became markedly less. There had been no evidence of inflammatory engorgement or of œdematous infiltration, and the patient had

improved rapidly since the removal of the mass. The scrotal walls were fully an inch in thickness.

In this case it is probably that as a complication of indurating œdema, infection with streptococcus erysipelatis set in and caused the acute exacerbation. When this subsided the case pursued its usual course. Streptococcus infection, it may be mentioned, is not at all uncommon during the course of early or late syphilitic lesions in both males and females.

This case also illustrated a condition not uncommon in indurating œdema, namely, a greater density of hardness in one part, in this case in the prepuce. In some cases, particularly in women, there may seem to be a central kernel of greater density surrounded by an atmosphere of elastic firmness.

While, as a rule, indurating œdema is the accompaniment of hard chancres, it may be observed during the first few years, particularly when the poison is active. In men, as in women, indurating œdema has been found to complicate mucous patches and condylomata lata, and to develop from traumatism and around such nonspecific lesions as chronic chancroids, herpetic ulcers, and various lesions of continuity. As a rule, however, the severe and extensive cases occur as complicating hard chancres. In any case the course is persistent and chronic.

The duration of indurating œdema depends almost wholly on the activity or persistence of treatment and on its early inception. Left untreated it may last for months and years, since spontaneous involution is very rare except in small infiltrations. Treatment, however, may produce prompt and satisfactory results.

In many cases this lesion, even if extensive, disappears and seems to leave no untoward result. In some instances, however, greater of less disfigurement or deformity of the parts is produced. An interesting and usual case of indurated œdema came under my notice some time ago.

CASE 4. The patient was a man, fifty years old, syphilitic ten years, a victim of chronic alcoholism, who had received very little and erratic treatment. He presented on the outer aspect of the prepuce an indurated nodule, which soon became eroded and looked like a classical chancrous erosion. The original initial lesion had appeared on this site. This recurrent lesion ran an

indolent course, was refractory to treatment, and soon became the focus of indurating œdema, which involved the integument of the whole organ. Coincidently gummatous nodules appeared on the right arm and leg (see Fig. 4). The penis became much swollen and unwieldy; the prepuce could not be retracted, and the parts presented a brick red color. The organ looked like a huge sausage. The classical history of indurating œdema prevailed in this case. A tardy cure was produced.

The interest in this case centres in the delayed appearance of the œdema and its exceptional development following a chancre redux (the *syphilide chancriforme tertiaire* of Fournier). I never saw a similar extensive case in the male.

### 2. SEQUELÆ OF INDURATING ŒDEMA

The sequelæ of indurating œdema of the penis are interesting. In some cases a phimotic condition is induced, and in others a tendency to balanoposthitis and paraphimosis. Herpes and dermatitis of the distal end of the organ are not uncommon. In some cases the œdema is followed by advanced atrophy of the integument, in which the tissues are transformed into a thin parchment-like tube, very finely wrinkled, resembling in appearance dried bladders and tobacco pouches. The atrophic tissues may be rather tightly stretched over the cavernous bodies, or they may be loose, flaccid, and baggy. These conditions are permanent. In nearly all stages indurating œdema is a bar to coitus.

### 3. DEFORMITIES FROM TERTIARY LESIONS

Besides indurating œdema, tertiary ulcers and gummatous infiltrations into the skin of the penis may disfigure that organ. In such cases the infection lasts for several or many years, appearing in crops and recrudescences, and at first hypertrophy of the parts is produced. Later on atrophy and shrinking may take place. I have seen cases in which gummatous infiltration began in the prepuce or glans, or both, and has travelled backward, involving both urethra and penile integument. In some cases nodes in the corpora cavernosa and infiltrations into the

corpus spongiosum have coexisted. In these cases such is the enlargement of the penis that pseudoelephantiasis is developed upward. I have studied a number of cases in old syphilitics with long prepuce, rather difficult of retraction, in which after long years of subacute balanitis and sometimes chronic gonorrhœa, the distal extremity of the penis has become slowly and gradually swollen. For a long time this hypertrophy was centred in the balantic region, then it gradually crept upward and involved all the integument of the penis. In this way the organ was permanently enlarged and a condition of pseudoelephantiasis was produced. In its advancing course penes thus attacked present an Indian club like appearance. Such cases may or may not be complicated by extra genital specific lesions. These cases are very refractory to treatment. An interesting case of this form of penile hypertrophy has been reported by Thiebierge in 1905. It is a good rule in cases of chronic hyperthrophy of the penis to suspect a syphilitic origin. There is a class of cases which is rare in occurrence and seen usually in old syphilitics, drunkards, and tramps, and in Southern luetic negroes. The disease begins in indurating œdema, gummatous infiltration, or specific ulcerations. In the course of several or many years the penis is converted into an unrecognizable monstrosity. The integument is greatly thickened and brawny, of a deep brownish red color, perhaps grossly papillomatous, and large and small scars and fissures are seated on its surface. The organ sometimes presents at its base a pedicle of huge size, which expands into a bulbous shaped mass like a big onion or beet, resembling the clapper of a bell. In some cases an enormous penis is capped by a head of the size of a large orange.

### 4. HYBRID ELEPHANTIASIC CASES

The foregoing cases are frankly syphilitic, but there is a group of cases in which there is a more or less vague history of syphilis and of undoubted gonorrhœa, and which are much aggravated by microbic complications. These hybrid borderline cases are not uncommon, and to them the term elephantiasis of the penis is usually applied.

This condition is portrayed in the figure (No. 5) in which

PLATE II.—Presented by Dr. Robert W. Taylor.




FIG. 4, CASE IV.—Indurating œdema and chancre redux.




FIG. 5.—Elephantiasis of penis and scrotum. From the tropics, symbiotic type. Not infrequent among the negroes of the South.

the hypertrophied scrotum and penis are well shown. Cases like this are not uncommon in tropical countries, and are seen not very infrequently in America in negroes, particularly in the South. They are mixed cases, in which syphilis, gonorrhœa, and chronic slow streptococci infection are the indiscriminate causal agents. In the mix up the histological appearance of syphilitic processes is obscured or effaced. In tropical climates filariæ may act as concomitant and causal agencies. When seen indigenous to American soil, they are classed as cases of elephantiasis nostras.

Having considered these syphilitic and quasi syphilitic cases, we are in a position to discuss certain other cases in which gonorrhœa, trauma, and lesions of continuity in and about the male genitals seemingly play the causative part.

For a full understanding of these cases it is absolutely necessary to have a clear conception of the ætiology of elephantiasis in the light of recent investigations.

### 5. ÆTIOLOGY OF GENITAL ELEPHANTIASIS

The ætiology of elephantiasis of the male and female genitals has long been in a condition of tangled uncertainty. When the discovery of the filariæ was made it was generally thought that the question had been settled, but in the process of time it became evident that some other cause than these nematode parasites was at the root of the trouble. While in tropical countries the filarial origin of all cases of elephantiasis has become the subject of doubt, the evidence of its being the cause of lesions of the male and female external genitals has not been forthcoming except in some rare cases of lymphscrotum. In America we have become accustomed in studying cases of these male and female lesions to incontinently attribute them to filarial origin. Histological studies by many skilled investigators, notably Sabouraud, Moncovo, Mavcacci, and Richandière, have clearly proved that these conclusions are incorrect. I can find no statement by any observer in America or Europe that he has ever found the filariæ in a case of elephantiasis of the penis. Hallopeau and Danlos seemed to think that if they could not discover the filariæ they might at least find their embryos, but their rigid search was in vain. In America numbers of cases of elephantiasis of the penis

have been seen, and the spectre of the filariæ always pervades the mind of their observers. The filariæ seem to be pudenal will-o'-the-wisps. From a quite complete study of these subjects I have reached certain conclusions, which I venture to offer as postulates.

1. That the filariæ are rarely, if ever, the sole pathogenetic cause of elephantiasis of the male genitals in extratropical countries, since their scientific demonstration has never been clearly formulated.

2. That in tropical climates there is inherent evidence in cases of elephantiasis of the penis and scrotum, that a hybrid or mixed condition is the underlying cause, the predisposing factors being uncleanliness and want of hygiene, and the exciting causes old uncured syphilis and gonorrhœa.

3. That it is probable that gonorrhœal infection in the urethra may have acted as an early factor of the inflammation, but that the gravamen of the attack was by the streptococcus (possibly erysipelatis), which in all countries seems to be the pathogenetic cause.

4. That congenital anomalies of the lymphatics may perhaps be concerned in the processes inviting ectasis.

5. That owing to their attenuation or by reason of involution forms of the microbes, the morbid process runs the long continued, usually aphlegmasic course commonly observed. In many instances, however, exacerbations are noted, pointing to a recrudescence of the virility of the microbes or to the accession of new colonies.

6. That in America and undoubtedly in Europe elephantiasis of the male genitals is never of filarial origin unless the disease started in tropical regions, and then it is a moot question whether it was the sole *materies morbi*.

These studies rid us of much error and uncertainty. Incidentally they may save observers tiresome and fruitless searches for those *ignes fatui*—the filariæ.

When we approach a case of elephantiasis of the penis or scrotum, or both, we can bear in mind certain accredited facts, namely, that the case may be one of old syphilis and of antecedent gonorrhœa, and that while in an occult way chronic syphilis may be a causative factor, in all cases the infection of the streptococcus

plays a leading part. Cases following gonorrhœa are not dependent on the gonococcus as the essential causal agent, since these energetic microbes merely play the part of sappers and miners, and, disappearing, produce a focus and pasture ground for the more tenaceous streptococcus.

### 6. ELEPHANTIASIS (NOSTRAS) OF PENIS

Two personal cases are illuminating.

CASE 5. The first patient was a young man, twenty-two years old. He had suffered from gonorrhœa, and had used very strong injections, which had given rise to inflammation of the whole penis, the organ being described as much enlarged, red, and painful. This primary hyperæmia slowly subsided, and then the penis began to swell in its preputial portion. This swelling, sometimes accompanied by transient hyperæmia, went on steadily, and in two years produced the deformity seen in Fig. 6. The penis was so elongated that it reached nearly to the knees. Its distal portion was the largest, where its circumference was about ten inches. Near the scrotum the organ was rather more than twice its normal size. The diseased tissue was firm and brawny. Its surface was channelled by numerous furrows running in a longitudinal direction. These furrows were crossed at right angles and more or less obliquely by other furrows, and thus the skin was divided up into lobulations and nodulations which were seated side by side like paving stones. This tumor was removed, and a very serviceable penis was produced. There was no obstruction to urination. No filariæ were found in this case.

CASE 6. Another case seen by me was one of elephantiasis beginning in the prepuce, which was much enlarged, so that the penis looked very much like an Indian club. The patient was a young Hebrew, who stated that his deformity dated from the day when a woman gave his penis a vicious twisting squeeze. The organ swelled, particularly at the line of union formed by circumcision. From this the swelling increased, accompanied at times by transient hyperæmia. I have recently seen this case again, after a lapse of many years, and I observed that the deformity had considerably increased in size. It seems that the man had imperfect coitus with a woman and contracted a severe

gonorrhœa. On its subsidence the old elephantiasis assumed a renewed vigor of life and went on to giant proportions.

I have seen many instances in which phimosis, paraphimosis and balanoposthitis, usually complications of gonorrhœa, have been the starting points of moderate enlargement of the penis, to which, however, the term elephantiasis could not strictly be applied. In literature such a causation has several times been noted or alleged in advanced cases of incarcerated subpreputial warts accompanied with much inflammation. Preputial chancroids may also be factors of gravity. Chancroidal phimosis may eventuate in elephantiasic enlargement of the penis.

### 7. ELEPHANTIASIS (NOSTRAS) FROM TRAUMATISM

Cases of traumatic elephantiasis of the penis are certainly not common. The following personal recital is interesting:

CASE 7. The patient, a man twenty-eight years old, before his injury had a penis of the ordinary size. During the Civil War he was shot at the base of the penis and in the left inguinal region. After the wounds healed it was noticed that the man's penis began to grow, and this hypertrophy continued for years. When he came under my observation his penis was, when flaccid, fully twelve inches long and proportionally longer when erect. This case was not an example of traumatic elephantiasis alone, since besides the increase in the connective and lymphoid tissues there was commensurate enlargement of the glans penis, the corpora cavernosa, and corpus spongiosum. When erect, according to the man's story, the penis was of monstrous size, and he was forever barred from coitus. (See Fig. 7.)

In this case undoubtedly the punctured wound became infected with streptococci germs, which produced the inflammation and the distortion.

Instances in which wounds of the integument of the penis and of the urethra alone or in combination become inflamed and the seat of hypertrophy and distortion are sometimes observed. The following case, seen but not at the time treated by me, illustrates a peculiarly distressing result.

CASE 8. The patient was a man, thirty-two years old, who some years before had gonorrhœa which left him with several

PLATE III.—Presented by Dr. Robert W. Taylor.

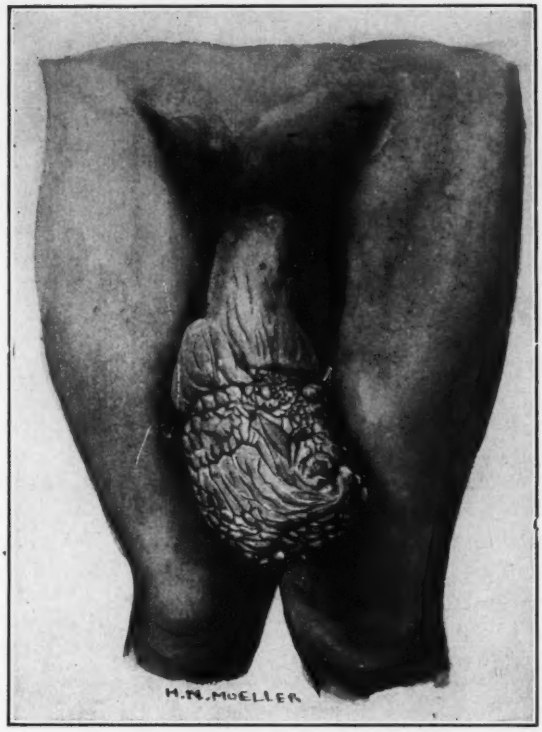



FIG. 6, CASE V.—Elephantiasis nostras of penis.

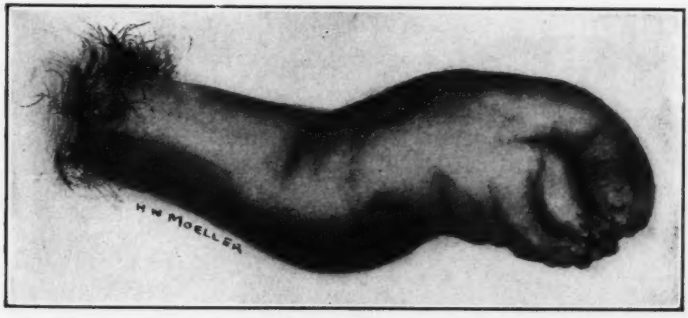



FIG. 7, CASE VII.—Elephantiasis nostras of penis of traumatic origin.

patches and rings of semi-fibrous hyperplasia of the urethra, reducing its calibre to 15 French. The normal urethra presented a diameter of 32 French. This gentleman was operated upon by an eminent surgeon by means of Otis's dilating urethrotome. The operation was performed in three séances with several days' interval, at which time numerous stricture bands were said to have been found and divided. At the end of the last operation the surgeon informed the patient that he was perfectly cured, and that he had dilated his urethra and had cut him up to 42 French. That night the gentleman had a terrible chill and alarming hæmorrhage developed. He had a very unhappy time for nearly three weeks. At that time urination was very painful, with dribbling and bloody oozing, and some increased temperature. Very soon the penis became red and swollen, and the man's sufferings were great. This swelling never went down, but it increased until his penis, in its whole extent, was four times its normal size. It thus remained in an elephantiasic condition, and was the cause of much mental torture to its bearer. He was forever barred from coitus, and he sorrowfully declared that his life had been ruined by these intemperate operations. Delicacy concerning his virile organ prevented him from prosecuting the surgeon. In this case we know now that streptococcus infection started in the surgical traumatisms in that man's urethra.

CASE 9. Weir reports an interesting case in a man fifty-nine years old. The patient had had stricture of the urethra in its penile portion, complicated by abscess formation. This left a fistula from which alone the urine thereafter flowed. Coincidently with the formation of the abscess the penis began to enlarge, generally painlessly, but sometimes pain was present. The whole organ was much enlarged, and presented the usual appearances of elephantiasis.

CASE 10. Voillemier reported in 1873 an interesting case of elephantiasis in a confirmed masturbator. The case seemed then inexplicable, for the man had always lived in France. The patient was twenty-nine years old, and had not had gonorrhœa or any disease of the penis. When he was twenty-two years old he found that his penis swelled at the point of junction of the organ with scrotum. Every spring and fall he noticed that these parts became red, and that he suffered from heat and painless

itching, and some fever. Such attacks lasted about two weeks, during which the swelling increased. After remaining stationary for a time the hypertrophy of the parts again increased until later on the penis and scrotum had assumed enormous proportions, necessitating ablation by surgical means.

In all probability this man in his vigorous manustupratory exercises caused much hyperæmia and hyperplasia of the penile urethra, and the parts becoming vulnerable, streptococcic infection set in and produced the elephantiasis. It was really a case of mild trauma.

These cases are sufficient to emphasize the fact that local traumatism plays an important part in the development of elephantiasis of the penis and scrotum.

A number of cases are reported in literature in which wounds of the urethra and penis have been followed by elephantiasis.

CASE 11. Shepherd reported a case of a fifteen year old boy, who, when three years old, fell upon and lacerated his urethra. He has since urinated through the torn end of the canal. After the accident the penis began to swell until it reached large proportions in length and diameter.

CASE 12. Rothschild reported two similar cases arising from fistula of the urethra. His contention that the disturbances in the circulation in the penis due to scar tissues was the starting point of the elephantiasis is beyond controversy. This observer was able to collect thirty-three cases of elephantiasis of the penis and scrotum, which he terms sporadic. In Stravino's case stricture of the urethra was the cause of the elephantiasis of the penis.

### 8. ELEPHANTIASIS FROM OPERATIONS FOR EXTIRPATION OF INGUINAL GANGLIA

Within the past fifteen years seven authors have referred to cases of elephantiasis of the penis and scrotum as a result of the total bilateral extirpation of the inguinal ganglia. This contingency must, therefore, be taken into consideration. It suggests the necessity of careful dissection of the inguinal regions, with the use of as little violence as possible in removing diseased ganglia. In many cases it will be well to remember that iodoform petrolatum injections are simple and efficacious in curing these af-

fections. With their use there is little fear of penile or scrotal hypertrophy. In one of my cases pseudoelephantiasis seemed to be imminent, but in a few months the swelling underwent complete resolution. Ravogli has also noticed that this elephantiasic condition may be temporary.

### 9. PATHOLOGY OF INDURATING ŒDEMA

Since indurating œdema is in most cases the outcome of a hard chancre, it is necessary to study the histology of both conditions combined.

In the primary lesion, or chancre, there is a small, round celled infiltration of the connective tissue, proliferation of the connective tissue cells, and an abundance of leucocytes. A chancre also shows more or less necrosis or degeneration of its constituent cells. An uncomplicated chancre in its early stages is identical in its general structure with a small superficial ulcer or patch of granuiation, excepting that in the chancre there is distinctly more necrosis and degeneration of its small spheroidal cells.

The bloodvessels surrounding the chancre, as well as those a considerable distance from the chancre, even in its earliest stages of development, are uniformly changed. The endothelial cells are swollen or proliferating, the walls of the vessels may be infiltrated, and finally, the perivascular spaces are crowded with proliferating polyhedral cells, among which are great numbers of plasma cells.

This early and extensive lesion of the lymph spaces about the bloodvessels, especially the smaller veins, enables us to understand more definitely how the virus of syphilis spreads, how it travels along these lymph spaces, accompanying the vessels to the root of the penis, to the first set of lymph nodes, the inguinal ganglia. From these inguinal nodes the cell proliferation, in response to the syphilitic virus, is propagated to the lymph nodes in general throughout the body in greater or less extent, and in this way general adenopathy is established. (See Figs. 8 and 9.)

In regard to this extension of syphilis through the perivascular spaces from the primary sore to the inguinal glands, it proceeds with great rapidity. As soon as the chancre appears the network of peripheral perivascular lymph spaces is already

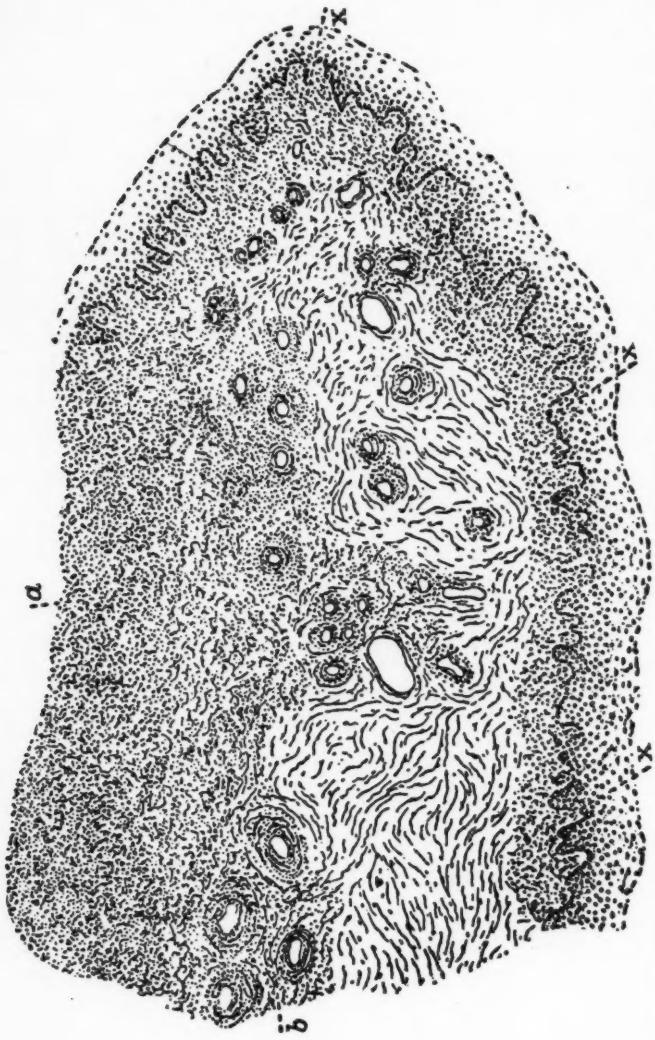



FIG. 8.—Microscopical section of chancre of penis, showing distention and infiltration into the derma, which extends as a zone from x x x to centre of chancre. Infiltration of walls of vessels well shown at b.

involved, and, as indicated by the line of proliferating cells along the venous lymph spaces, the virus is already on the path to the inguinal lymph nodes.

The stage of induration or indurating œdema remains to be considered in describing the structure of a chancre. If a chancre

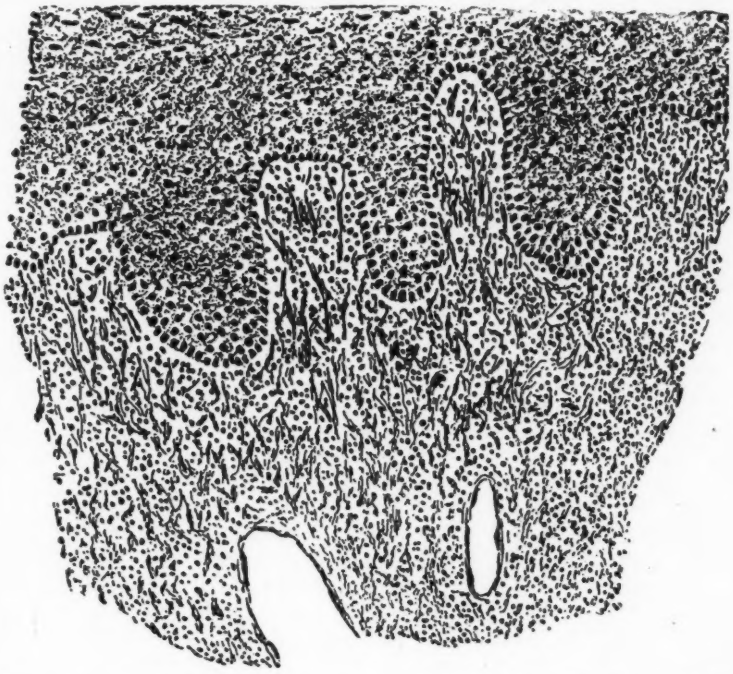


FIG. 9.—Microscopical section of chancre of penis. Portion of Fig. 8 more highly magnified. The interfibrillary spaces of the upper layers of the derma are infiltrated with fluid and small round cells.

at the well pronounced stage of induration be examined microscopically, it will be seen that the seminecrotic mass of small, spheroidal cells composing the bed and main bulk of the ulcer is circumvallated by a zone of œdema and cellular infiltration of the papillary portion of the derma. Indurating œdema, then, as the name implies, is the wall about the chancre wherein the inter-

fibrillary spaces of the pars papillaris are distended with fluid and small round cells.

To recapitulate briefly the series of changes in the chancre: When syphilitic poison penetrates the skin or mucous membrane, it excites local leucocytosis and exudative inflammation, with more or less necrosis; there is also proliferation of the connective tissue cells, a propagation of proliferating cells along the perivascular lymph spaces, and later a wall of infiltration and œdema of the upper corium layers formed about the periphery of the ulcer corresponding to the stage of indurating œdema.

### 10. PATHOLOGY OF THE HYBRID FORM OF ELEPHANTIASIS OF PENIS AND SCROTUM

The pathogenesis of elephantiasis centres about the process of proliferation of the connective tissue cells of the skin. No matter how varied the external manifestations, or the peculiarities of regional distribution of the disease may be, the essential and underlying mechanism of its production lies in the course of this proliferation of the connective tissue cells. The fixed connective tissue and apparently the wandering connective tissue cells or plasma cells divide and multiply. The new cells gradually elongate and become spindle shaped. Then these spindle-shaped derivatives of the connective tissue cells or fibroblasts finally become converted in the fibres, the basement substance of the dermal connective tissue. Little by little by means of this mechanism the skin becomes thicker and denser. As there is a practically unlimited supply of the dermal connective tissue cells the process has very little tendency to come to a standstill, but is liable to go on for years and become more and more pronounced. Yet, if the agency or agencies which promote this dermal cell growth abate, the process may halt and the hyperplasia cease.

The steps of this process are simple. When, however, we come to consider why these cells should go through this cycle and what it is that starts them, this matter becomes more complicated. One element, if indeed it is not the cardinal factor in inciting these cells to proliferation and thereby becoming responsible for the often enormous thickening of the skin is a disturbance of the lymphatics and their circulation. This is quite generally, in

fact almost uniformly, associated with the lesions, and may be regarded as the proximate cause of this connective tissue cell proliferation and consequent thickening of the skin. Whatever circumstances bring about lymphstasis, distention of the lymph spaces, damming back or retarding the lymph flow are liable to excite the dermal cell proliferation. Persistent venous congestion and dilatation changes in the periarterial or venous spaces, thickening of the vascular walls from whatever cause lead up to this disturbance of the lymph channels and lymph circulation.

In amplification, it is well to emphasize an anatomical peculiarity of the scrotum, the integument of the penis, and parts of the female pudenda which invite these disturbances in the lymphatic circulation and lymph stasis. From their structure it is to be expected that they would be par excellence the seats of election of lymphstasis and consequent hyperplasia. Now the integument almost everywhere else on the body is applied firmly over muscles, tendons, bones, joints and firmer tissues beneath. Consequently there is a firm bed underneath the general integument which opposes any distention and stasis of the lymphatics. The occurrence of such a condition can take place only after overcoming certain degrees of opposing pressure. But with the scrotum and penile integument and other pudendal parts the conditions are quite the reverse. Here the integument is loose in texture, and transudation of lymph can occur with the greatest facility and distend the dermal structures with the greatest ease unhampered by any opposing pressure.

Concerning the hybrid form of pudendal elephantiasis we find an underlying dormant condition of syphilis which by some obscure association of gonorrhœal infection awakens this elephantiasis. The two conditions seem in some way to act reciprocally and complementary to each other. Finally, it would seem in some cases as though this combined type of infections might remain quiescent were it not for the presence of the streptococcus as a third proximate causal factor. The combination of the first two factors in a certain case seems ineffectual by themselves, but depends upon the incitement of the streptococcus to awaken and continue the hyperplasia, resulting in elephantiasis.

An exposition of the histological process at work in this hybrid type is shown in Fig. 10. Here is shown a section through

the scrotum of a negro with tertiary syphilis, and who in addition had had continuous attacks of gonorrhœa, and besides this at one minute ulcerated patch an invasion of *streptococcus pyogenes*. In this section of the scrotum, increased fully eight or ten fold its normal thickness, are the smooth muscle bundles cut longitudinally and transversely. There has been a new growth of these smooth muscle bundles, and this has contributed very materially fully as much if not more than the connective tissue hyperplasia to the increased thickness of the parts.

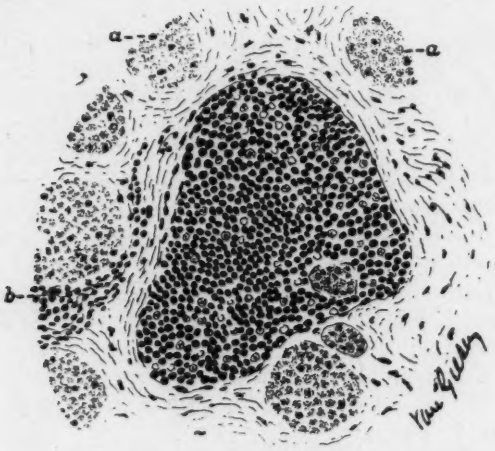



FIG. 11.—More highly magnified than in picture of round cell distention of one of the lymph spaces of preceding figure. a a, newly formed smooth muscle bundles cut transversely; b, patch of proliferating connective tissue cells.

We are not concerned with the details of this hypertrophy and hyperplasia of the smooth muscles, since this is incidental to a particular structure of the scrotum and is a side issue in determining the generic process in these various types of deformities and enlargements of the penile tissues. The striking and rather characteristic syphilitic feature of the section is the distention of the larger and smaller lymph spaces with small round cells. These seem to be the progeny of the endothelial cells originally lining such lymph

PLATE IV.—Presented by Dr. Robert W. Taylor.

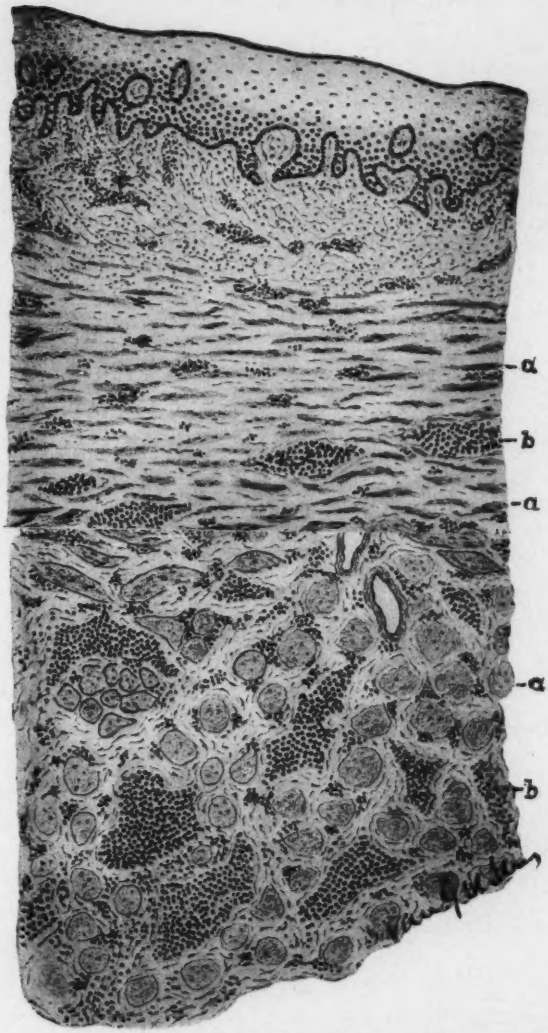



FIG. 10.—Elephantiasis of scrotum (thickened eight times) in a hybrid case of gonorrhœa and syphilis (symbiotic type). a a, smooth muscle bundles of scrotum; b b small round cell distention of lymph spaces.

channels. If this is the derivation of these clusters they are likely to meet the fate of phagocytosis, and not furnish new connective tissue. At any rate it can be clearly observed that the lymph channels are completely and thoroughly blocked up with these cells (see Fig. 11, a more highly magnified view of a lymph space thus occluded with a cluster of small round cells). This occlusion of the lymph channels is sufficient to set up proliferation of the connective tissue cells with resultant fibroblasts and increase of

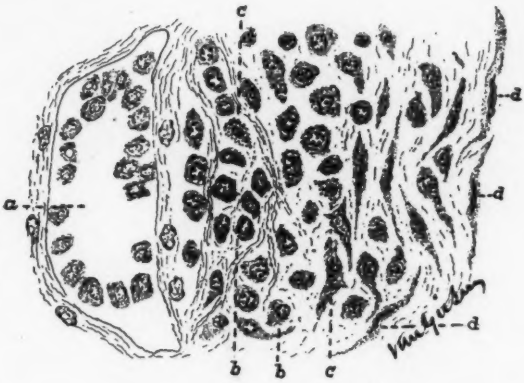



FIG. 12.—Showing genesis of fibroblasts in development of new connective tissue formation (essential cause of hyperplasia). a, small lymph vessel or vein with desquamating swollen endothelial cells; b b, a group of polynuclear cells in the crevices of the connective tissue, some of which are plasma cells, others mast cells, and others the progeny of connective tissue cells; c c, mast cells, d d, fibroblasts.

the connective tissue matrix. That course of events is shown in Fig. 12, a still more highly magnified view of a cluster of cells in the interstices of the connective tissue as, for instance, as at B in Fig. 11. In the figure is a small lymph space (or the thin walled vein) with swollen desquamated endothelium and surrounded by a group of proliferated connective tissue cells among which are plasma cells and mast cells and also fibroblasts. It is through the development of these fibroblasts that new fibres of the connective tissues are formed. And, hence, the slow increase in the total thickness of the skin.

FIG. 13.—Elephantiasis nostras of integument of penis (enormously thickened), showing chronic lymphangiectasis.

### 11. PATHOLOGY OF ELEPHANTIASIS NOSTRAS

After the consideration of the histogenesis of the preceding condition this section may be dealt with briefly. A study of figure 13 will save text. This figure is from a section of the penile integument in a case of elephantiasis. Some idea of the increase in size may be gained from the fact that this integument is fully an inch in thickness. A glance at the figure shows the very great distention of the lymph channels—a chronic lymphangiectasis. This lymphangiectasis once started and becoming persistent the connective tissue proliferation is an almost inevitable sequence. This connective cell proliferation may be seen in the clusters of cells around and between the dilated lymph spaces. Were one of these clusters more highly magnified and analyzed in detail we would have a duplicate picture of Fig. 12, in brief proliferating connective tissue cells forming fibroblasts, which in turn form new connective tissue fibres; from which result a slow and continuous thickening of the skin with lymphangiectasis.

## DISCUSSION

Dr. JOHN H. CUNNINGHAM, Jr., of Boston, said he was pleased yet surprised to hear that Dr. Taylor had found no cases of elephantiasis of the penis which had been known to be of filarial origin. He was impressed by this fact recently while looking over the literature in preparing a thesis upon filariasis for this Association. Although lymph scrotum, and elephantiasis of the scrotum and penis, and elephantiasis of the lower extremities had all been shown to be caused by the filaria, none of the cases of elephantiasis of the penis alone had been attributed to that cause. It is known that the filaria Bancrofti occludes the lymphatics, either by its own presence, or secondarily by producing an inflammation which constricts them, causing a dilatation distal to the point of the obstruction. These dilated lymphatics result in varicosties and lymphatic œdema, lymph scrotum, and elephantiasis of the part distal to the occluded lymphatics. The rupture of these dilated lymphatics into the peritoneal cavity produces chylous ascites; into the urinary tract, chyluria; into the scrotum, chylous hydrocele, etc. He asked Dr. Taylor whether incision into the penis affected with elephantiasis would bring forth a chylous fluid or not. He had been unable to find anything on this point in

the literature, but had presumed elephantiasis of the penis to be, like elephantiasis elsewhere, of filarial origin.

Dr. TAYLOR, in closing, said that it seemed that the filariæ, like Belinda's Betty, were praised for labors not their own. Dr. Newnas, a gentleman in the Barbadoes, made extensive examinations of cases of elephantiasis, and he was struck with the fact that he did not find the filariæ at all. Dr. Taylor imagined that it was case in which generalizations had been made upon a few cases. It was found in Southern climates that the filaria caused subcutaneous abscesses, but this long-continued hyperplasia that we called elephantiasis was undoubtedly caused by the streptococcus. In Southern climates a little ulcer would occur and then become infected with the streptococcus. Then again, this streptococcus infection was sometimes hereditary. Moncorvo had reported cases of children having been born with elephantiasis. As to the occurrence of chylous fluid on incising the penis, it was found in Case VI, but was not found in Case VII. His studies convinced him that this whole subject had been misunderstood.

## EPIDIDYMO-VASOSTOMY AS A CURE FOR STERILITY

By EDWARD MARTIN, of Philadelphia

Professor of Clinical Surgery, University of Pennsylvania

SINCE my last report in the spring of 1906 on the results obtained in the treatment of sterility due to obliteration of the tail of the epididymis by epididymo-vasostomy, giving the history of at least two completely successful cases, my experience with this operation has been one of unbroken failure.

This, however, has been due not to the fact that such an anastomosis is difficult of accomplishment, but because the cases coming for treatment exhibited either congenital deficiency of the vas, its obliteration at a higher point, or atrophy of the secreting substance of the testicles.

In one case operated on by myself and one case treated by Dr. Levi, there was complete absence of the vas.

In one case in which the vas was present and normally patulous, and the head of the epididymis on section showed the presence of numerous living spermatozoa, the operation was

futile because of obliteration at a higher point, as shown subsequently by the injection of colored fluid which failed to appear either in the urine or in the fluid expressed by vesical and ampullar massage.

In one case in which sterility was apparently dependent upon orchitis due to mumps, sections in the epididymis and into the testicle failed to show the presence of spermatozoa.

One case operated upon by Dr. Carnett, with urethral stricture and persistent posterior symptoms afterwards suffered from severe epididymitis.

Before the operation is undertaken strictures, post-urethral lesions, and chronic inflammation of the seminal vesicles and vas should be cured.

The patency of the vas from the epididymis to the prostatic urethra should be assured by an injection into the lumen of the vas of a watery emulsion of inert pigment, which, when passed with the urine or expressed by massage of the vasal ampulla, readily may be recognized.

This preliminary operation may be accomplished under local anæsthesia by means of either an ordinary hypodermic syringe, the needle of which is blunted, or the small syringe used by oculists for washing out the lachrymal duct. The vas is held just beneath the skin by the fingers of an assistant, the line of incision is infiltrated, the vas is exposed, slit longitudinally, and from twenty to thirty drops of the injection are driven in. A large injection is likely to occasion severe pain at the base of the bladder (Belfield). If the pigment does not appear either in the urine, in the seminal discharge, or as the result of massage, an anastomosis between the vas and epididymis will be futile. This trifling preliminary operation takes but a few minutes, and if a suspensory bandage be worn need delay the patient from his business not at all.

The operation of anastomosis is a trifle more complicated because of the smallness of the structures involved. It, however, can be done perfectly under local anæsthesia, and if care be taken to avoid traumatizing the veins, causes no loss of time to the patient other than that required by the procedure.

I have been in the habit of cutting a longitudinal opening in the vas and not dividing it completely across. This makes the

accurate application of sutures difficult. I believe it is better to cut the vas obliquely, split it upward for a quarter of an inch and sew this wide stretched lumen to the opening made either into the epididymis, or, if spermatozoa are not found there, into the testicle. The microscopist should be at hand who examines the fluid which exudes from the epididymis when it is opened. This opening is made by the pinching up of a very small portion of it in a pair of conjunctival rat-tooth forceps, and snipping this portion off by a pair of eye scissors, curved on the flat. Usually, together with a little blood, a yellowish fluid will exude. This taken up on a cover-glass will show innumerable and motile spermatozoa. If spermatozoa are not present, other openings must be made into the epididymis or testicle until spermatozoa are found.

The anastomosis between the cut ends of the vas and epididymis may be made by means of four sutures carried by fine curved eye needles. Either silk or fine silver wire answers well. The suture is carried from without in through the wall of the vas, and from within out through the wall of the epididymis. The tying down of these sutures completes the anastomosis. The approach to the epididymis and vas is easiest through the posterior scrotal wall. It usually does not require the application of a single ligature. The veins should be carefully spared, otherwise troublesome and painful thrombosis will develop. When the operation is conducted with due gentleness, and the wound closed by a buried cumol catgut suture, a superficial thread of silk and the application of a sterile dressing, cotton, and a jock strap, the patient can go about his business.

In two of my cases there was no immediate return of spermatozoa in the emissions, but weeks or months later they reappeared. Both of these patients had been subject to prolonged and very carefully applied urethral treatment previous to operation.

Although my recent experience has not been encouraging, this is becouse the patients who presented themselves for operation happened to be unfitted for it. There are as opposed to this, and of more value than successes in my own hands, a number of cases now recorded of completely satisfactory results following the operation done by others. Dr. Horwitz, in a personal com-

munication, has given me the history of one such case in which not only did spermatozoa appear, but a marriage, previously sterile, became fruitful, and I believe Dr. Hagner has a similar case to report at this meeting.

My own work in the last year has served to demonstrate that sterility in the male is dependent on mechanical causes other than obliteration at the tail of the epididymis, and that before attempting an epididymo-vasostomy, it is well to be assured that such other causes do not exist.

## DISCUSSION

Dr. EDWARD L. KEYES, Jr., of New York, asked Dr. Martin if he tapped the vas posteriorly.

Dr. HUGH H. YOUNG, of Baltimore, said it was observed several years ago by Dimitresco, that years after an epididymectomy for enlarged prostate living spermatozoa were still present in the testicle. Spermatozoa had also been found in testicles in which the vasa deferentia were congenitally absent. Dr. Martin was much to be congratulated upon this splendid pioneer work.

Dr. MARTIN said, in answer to Dr. van der Poel's question, that he had reported a case last year in which the wife of the patient became pregnant after the operation. It was the case mentioned by Dr. Hagner, and the proof seemed to be complete. This last year had been characterized by unbroken failure. He had had not one successful case. Yet the reasons for failure in each case were apparent and mechanical. All of the cases had active, motile, healthy spermatozoa. There was one case in which there was such a deep-seated, long-continued inflammation of the entire epididymis that no spermatozoa could be found, and the testicle itself was tapped, and even there no spermatozoa were found, but subsequently they were found at the time the anastomosis was made. He had found that the obstruction was not necessarily confined to the epididymis, but might be in the ejaculatory ducts or the vas. To determine whether the vas and ejaculatory ducts were patulous, a slit was made in the vas, and with a little syringe used by the eye specialists a suspension of some insoluble dye was injected into the vas. If the vas was patulous it would appear at the next ejaculation. All the cases operated on failed absolutely to show any signs of color, showing that there was an obliteration above the epididymis. It had been found that the operation could be done perfectly well under local anæsthesia. It delayed the patient from

his vocation not at all. It was important to handle the veins of the cord with extreme gentleness, in order to prevent phlebitis. It was extraordinary the number of cases that came for this operation—for instance, after mumps. In most of those cases there was apt to be an atrophy so great that the operation was not available. He had demonstrated that where conditions were favorable the operation was not only successful, but it apparently remained permanently so. There seemed to be no tendency to close up. In some cases it had now been several years since operation, and active spermatozoa were still present. It was desirable before the operation to get rid of the chronic posterior urethritis which usually accompanied these old cases of epididymitis. In reply to the question asked by Dr. Keyes, Dr. Martin said the vas was reached by the shortest route, which was the posterior. The tunica vaginalis was cut through, and the whole of the epididymis exposed. With a pair of forceps used by the eye-men a portion of the epididymis was picked up and snipped out with eye scissors. If spermatozoa were present a characteristic drop would appear in the wound. This was examined microscopically and reported on. If spermatozoa were not found, he went a little higher up and deeper in. He had opened the testicle itself and found spermatozoa. The openings were closed by a very fine stitch. The most surprising feature was that a man who had never had a vas had motile and healthy spermatozoa. The closure of the duct was not followed by atrophy in these cases. The fact was also demonstrated that the spermatozoa were motile before they came to the prostatic fluid. The spermatozoa did not need for their full, fertile development passage through the epididymis, nor did they need admixture with the prostatic fluid, so that the suggestion had come to his mind that it might be possible to extract from the male testicle the spermatozoön, from the female a ripe egg, and plant them in the uterus of a second woman who would bear the child.

# REPORT OF TWO CASES OF STERILITY IN THE MALE WITH SUCCESSFUL ANASTOMOSIS BETWEEN THE VAS DEFERENS AND GLOBUS MAJOR

By Francis R. Hagner, M. D., of Washington.

TWO cases of sterility, following double gonorrhœal epididymitis that have come under my observation have been operated upon, the first by Dr. Martin and the second by myself. A brief report of the first case is as follows:

A robust appearing man of 36, of normal sexual desire, had been married several years and had had no children. His wife had been examined and no cause for sterility ascertained. Frequent examinations of the spermatic fluid showed no spermatozoa, but the fluid contained numerous pus cells; the prostate and seminal vesicles showed evidence of chronic inflammation. After treatment the pus diminished very materially and the prostate and seminal vesicles on examination appeared normal. He was very anxious to have a child and I advised him of the operation recommended by Dr. Martin. He was operated on by Dr. Martin about two years ago. When he returned to Washington, his ejaculated fluid contained motile spermatozoa. His wife has not given birth to a full term child, but has succeeded in having a miscarriage.

## THE SECOND

T. D., 29 years old, was referred to me in February, 1906, by Dr. Wall. The patient was a robust, healthy man over six feet tall and weighed 225 pounds. He had gonorrhœa two years previous and a double epididymitis three weeks later. On examination there were found numerous shreds in both urines and some free pus. On rectal examination I found a large soft prostate and markedly enlarged vesicles. The fluid expressed by massage showed numerous pus cells but no spermatozoa. The patient was treated for six months by which time the shreds had disappeared and the prostatic fluid was free from pus. He then married and returned in six months complaining because his wife had not become pregnant. Dr. Kelley had examined his wife and could find

no reason for pregnancy not occurring. Examination of the semen showed no spermatozoa. As he was very passionate and had been having frequent coitus it was thought possible that this might account for the absence of the spermatozoa. He abstained from coitus for two weeks and the semen still failed to show spermatozoa.

He was kept under observation for two months more and repeated examinations made proved the absence of cells that could possibly have been spermatozoa. He was advised and consented to undergo an operation for anastomosis of the vas deferens and epididymis, as his only chance for improvement. This was done in May one year ago at Garfield Hospital, both sides being operated upon at the same time. The operation was performed, as advised by Dr. Martin, fine silver wire and curved intestinal needles being used. When the little wedge-shaped piece was removed from the globus major, a little whitish fluid exuded that showed spermatozoa—their motility was not determined as the specimen dried before the examination was made.

Recovery was uninterrupted and he left the hospital in one week. Examination in two weeks showed no spermatozoa, but another examination a month after the operation disclosed their presence in numbers. In looking over the report of Dr. Martin's cases, I noticed one case did not show spermatozoa for two months and another a longer time, and as my own case did not show a return for a month it has occurred to me that possibly following the operation, an inflammatory infiltration takes place causing a temporary occlusion of the vas deferens and as this is absorbed the tube becomes patulous. I have kept this patient under observation for a year; so far no pregnancy has resulted, but both the patient and I are still hopeful. An examination of the ejaculated fluid made within two weeks showed it swarming with motile spermatozoa.

## DISCUSSION

Dr. L. Bolton Bangs, of New York, had had no personal experience with this operation. He had considered it, and was hoping to have an opportunity of doing it, because it seemed to open a wide field of conservatism and of hopefulness to those who were, at present at least, permanently

sterile. There were some things about Dr. Martin's cases that he had hoped to have the opportunity of talking with him about. He wanted to know what percentage of successful cases, *i. e.*, curable cases, Dr. Martin had had out of his number; also whether the operative procedure was durable in the sense of being permanent, because there were opportunities of getting an epididymitis after such an operation; and also whether in such cases there was a return of the absence of spermatozoa.

Dr. HAGNER said, in closing, that he thought Dr. Martin reported 5 cases last year. He thought they were nearly all successful, in that they had a return of spermatozoa. Whether they tended to relapse or not, whether the spermatozoa afterwards disappeared or not, he could not say definitely, as the operation was still more or less in its infancy. In his own case the spermatozoa showed an increase at every examination. The last examination, a year after the operation, the semen was loaded with live spermatozoa.

SUBSEQUENT NOTE.—The wife of patient No. 2 has become pregnant since the report of this case and is now in her sixth month.

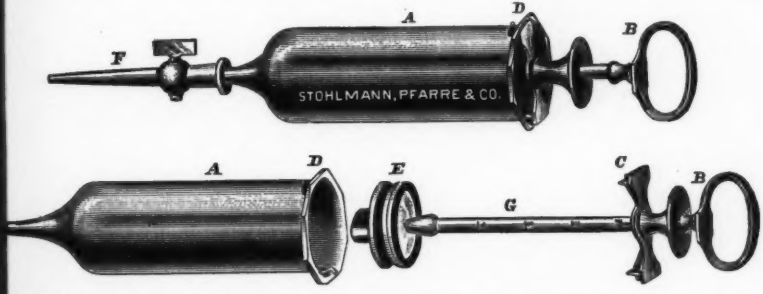
## Second Day, May 8, 1907

### HAYDEN'S IRRIGATION SYRINGE, STAFF, AND ASPIRATOR

By J. R. HAYDEN, M. D., of New York

#### THE IRRIGATION SYRINGE

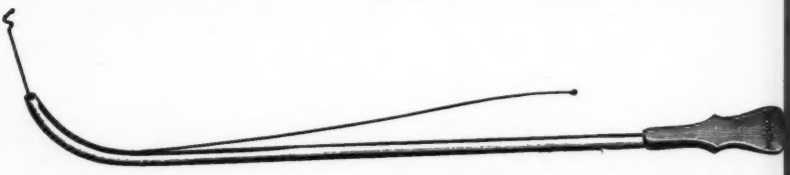
THIS syringe being constructed entirely of metal can be boiled without injury, which is a decided advantage over those made of glass and metal. The barrel and piston-rod are of such a length as to be conveniently held and operated with one hand, which is not the case with the larger type of syringe. The plunger is constructed of metal and rubber, and can




by a simple screw arrangement be expanded or contracted to fit the barrel nicely; when the rubber loses its elasticity it can be readily replaced. The tapering coupler with stopcock fits any size catheter, and the cock when closed prevents the escape of fluid from the bladder, when the syringe is disconnected for refilling. The bayonet joint enables one to take the syringe apart quickly for purposes of cleaning, and the octagonal end of the barrel prevents it from rolling when laid down.

### THE STAFF

In performing external urethrotomy with the ordinary grooved staff, there is always danger of cutting the filiform guide as it lies in the groove on the *convex* surface of the staff (toward the operator). So to obviate this annoying accident, I have had Messrs. Tieman & Co. make me a tunneled staff, with two



grooves, a narrow one on its *concave* side, in which the filiform lies, and a long, broad and deep one on its *convex* side, over which the perineal tissues may be freely incised without the slightest danger of cutting the filiform; this long groove is also a good guide to the median line, as it extends to the handle of the staff, and can therefore be seen by the operator as it emerges from the meatus.

### THE ASPIRATOR

The advantages of this aspirator are that it takes up little room, is easily taken apart, cleaned and sterilized, and can be

used with equal advantage both for aspirating the bladder and tapping a hydrocele. The tumor being punctured, the trocar is withdrawn into the water-tight section (B), the urine or hydrocele fluid flowing out of the curved outflow tube (A) downward into a vessel, and not straight backward as in the old type of instrument. When the bladder is to be aspirated, a piece of rubber tubing is attached to the outflow tube (A) so that all of the urine can be readily collected and measured.

## DISCUSSION

Dr. EDWARD L. KEYES, Jr., of New York, said he had used the syringe presented by Dr. Hayden, and it was very much better than any large syringe he had ever found before.

Dr. JOHN VAN DER POEL, of New York, said he was very much interested in Dr. Hayden's guide and tunneled sound. Two or three years ago he had shown a modification of the same instrument, but with a Benique or Guyon curve, with sizes from No. 8 to 24 French. In the clinic one frequently saw cases of stricture where only a filiform could be passed, and often these patients would not submit to operation, but insisted upon dilatation. Not infrequently when they again presented themselves, the stricture, through which perhaps a 9 or 10 tunneled sound had been passed, would have retracted down to the same condition as before, when it was necessary to repeat the process of filling the urethra with filiforms, finding a passage, and finally again stretching it up to 9 or 10 French. In consequence of this, he thought it wise to have made a successive number of sounds to pass over the filiform, in order to perform rapid dilatation up to 14, 15 or even to 20 French, after which it was generally possible to pass the ordinary bougies or sounds at the next sitting. The Benique curve was used, not only because sounds of this shape were often more easily passed, but he had found in performing external urethrotomy that that curve was more practical, because with a strong sound the perineum could be pressed outward until its tissues were not much over a half inch in thickness, instead of having, as when we used the ordinary curved sound, to cut through a large amount of more or less spongy tissue. His sounds, however, did not have the advantage of having the filiform on the anterior surface, though he did not think that absolutely essential, as the filiform could usually be removed before operation. He had found two cases in which the Benique curve did not pass so well over the filiform as the old simple curve, but in the majority of cases he had found that it worked better, either with or without a guide.

Dr. HARVEY G. MUDD, of St. Louis, asked Dr. Hayden if he had found that having the grove on the anterior surface did actually facilitate the passage of the tunneled sound.

Dr. HAYDEN, in closing, said that in his tunneled sound the filiform, being on the concave surface of the instrument, could not be cut during the operation. Sometimes in using Gouley's sound he had cut the guide, which was an annoying accident, as the distal end of the filiform slipped into the bladder and took some time to find and extract. The only claim for merit was that

the filiform was out of danger, the operation could be done more rapidly, and there was a broad groove on the convex surface to cut down upon that was easily felt with the tip of the knife.

## PUS TUBES IN THE MALE

By WILLIAM T. BELFIELD, M. D., of Chicago

I. *Anatomical Considerations.*—The genital canal of the male presents certain anatomical features which assume clinical importance when infections of this canal occur. Among these the following deserve mention:

1. The lacunæ of the posterior half of the penile urethra open backwards toward the bladder. This arrangement, at first sight paradoxical, is really advantageous, for the rear half of the anterior urethra descends from the scrotal to the bulbous portion; hence the orifices of these backward opening lacunæ are the lowest points, affording a gravity drainage that would be otherwise impossible. The clinical application of this fact is that in massaging the urethra against a contained sound—a valuable measure for emptying the lacunæ in cases of persistent infection—the strokes should be directed from behind forward in the anterior half of the urethra only, but from before backwards in the posterior half.

2. Prostatic concretions, though in principle foreign bodies, are in practice normal anatomical features, because they are found in the prostatic follicles of practically every adult male over thirty-five years of age. In later years they are commonly encrusted with lime salts and frequently provoke suppuration in the follicles. Such inflammations are clinically important because first, they produce the vesical irritation and prostatic swelling so common in elderly men, which have led to many needless prostatectomies and which are promptly relieved by massage; and second, because the infection inaugurated by these concretions frequently extends to the vesicles, the vasa deferentia and the epididymes, especially in elderly men. The spontaneous

epididymitis, and the chronic hydrocele so common in these patients seem often attributable primarily to these concretions.

3. The utricle, a vestige not of the Müllerian duct as commonly assumed, but of the urogenital sinus, has a distinct clinical importance, though ignored in our standard works. Indeed in the entire literature I have been able to find only three references to diseased conditions of this sac—first, that of English (1873), who found in five of seventy autopsies of newborn infants the utricle distended with fluid, sometimes rivaling the urinary bladder in size; second, Belfield's account (1894), of several cases of abscesses of the utricle requiring incision; and third Kapsamer's report (1901), of the removal from the utricle of a calculus as large as a goose-egg. There are recorded, however, several cases of retro-vesical cysts which, though apparently distended utricles, were assumed by the observers to have originated in the seminal vesicles, simply because no other explanation occurred to them. Such are the classical cases of Smith and of Ralfe, quoted in our text-books as cysts of the vesicle. In Smith's case the pyriform tumor rising above the umbilicus was at first mistaken for a distended bladder; puncture per rectum evacuated ten pints of brown serous fluid. In Ralfe's case the sac was found post-mortem to have no communication with the vesicle, but to arise from the prostate. Fisk (*Annals of Surgery*, 1898), and Guiteras (*Lancet*, 1894) also report cysts ascribed to the vesicles without mentioning the possible origin in the utricle, which is strongly suggested by their descriptions. Calculi reported to have been removed from the prostate or the recto-vesical space seem to have been in several instances concretions in the utricle, like Kapsamer's.

Infection and abscess of the utricle are frequent; in the article above mentioned, published thirteen years ago, I reported several and I have seen many since. A typical gonorrhœal abscess of the utricle was recently observed by Dr. L. E. Schmidt and myself; the symptoms were those commonly ascribed to prostatic abscess, but the fluctuating swelling was in the median line. With the finger-nail the abscess was opened from the rectum; after the escape of perhaps an ounce of pus, the swelling had vanished, leaving a groove between the lateral lobes.

The clinical value of a differential diagnosis between prostatic and utricular abscess arises from the diverse anatomical

relations of the two abscesses. For the utricle is entirely external to the prostatic capsule, and is separated from the rectum merely by a thin layer of connective tissue. Utricular abscesses often break into the rectum spontaneously, and they should be incised from the bowel when incision is necessary. No escape of urine into the bowel nor urethro-rectal fistula follows.

Abscess originating in the prostate, on the other hand, is doubtless better opened from the perineum, as is now customary.

4. Our text-books on anatomy describe the ejaculatory ducts as running in the walls of the utricle and opening into the prostatic urethra. This is the usual but not the invariable arrangement, for one or both ducts may open into the utricle; the latter is the normal relation in many lower animals, including the rodents. In ten human cadavers I found four of the twenty ejaculatory ducts opening into the utricle. This anatomical relation constitutes another serious obstacle to the medication of the seminal vesicles by injection through the ejaculatory ducts—a measure that has been often suggested and occasionally executed, usually with an epididymitis as an incidental sequel. Such was the experience of Klotz, one of the pioneers in this maneuver, and of myself. For several obvious reasons, medication of the seminal vesicles by this route seems impracticable.

II. *Clinical Considerations.*—The usual infections of the seminal duct and vesicle are three: the gonococcus, tubercle bacillus, and pyogenic bacteria. The two first-named receive due consideration in text-books and current literature; it is the primary infections by the pyogenic bacteria to which I desire to call attention.

The seminal tube, like other tissues, seems to possess in the healthy state complete immunity against the ordinary pus bacteria, and to yield to such infections only when its tissues have been damaged. Hence pus infection of the seminal tube commonly follows one of four causes: spinal cord disease, especially tabes; damage by the gonococcus; stricture of the bulbous urethra; and prostatic concretions. Pus tubes are therefore common at all ages; in younger men they are sometimes mistaken for gonorrhœa, in older men for cystitis and prostatic hypertrophy.

The lesions produced in the seminal tube by the pyogenic bacteria vary in degree; the more severe infections induce free

suppuration in the vesicles, and epididymitis, often purulent. We have all seen elderly men who have had frequent urination for some time suddenly develop severe symptoms—often miscalled acute cystitis—perhaps with complete retention of urine, and later a suppurating epididymitis. The less severe infections induce a connective tissue thickening in the vesicle, tube, and epididymis, often with chronic hydrocele, so common in elderly men, and sometimes with neuralgia testis. Usually the lumen of the epididymis is obliterated, with consequent azoospermia and sterility—which is not rare even where no gonorrhœal epididymitis has ever existed. In some cases this chronic infection invades the tubules of the testis, producing impotence.

*Symptoms.*—The acute pyogenic and acute gonorrhœal infections of the vesicle induce identical symptoms, which need not be detailed here.

The chronic pus infections produce the symptoms usually ascribed to chronic cystitis and pyelitis—unduly frequent and painful urination, pyuria and partial retention of urine. The urine often contains albumin derived not from the kidney, but from the vesicular secretion. (I have more than once seen distinct albuminuria in young men during a strenuous courtship, which disappeared during the honeymoon journey.)

These chronic infections may also cause painful, spasmodic contractions of the seminal vesicle—a real spermatic colic,—which may easily be mistaken for renal colic, because the pain is felt in the lumbar and inguinal regions and in the testes; and because blood and pus, derived from the vesicle, may appear in the urine.

The pain of the infected vas on the right side has been in at least one instance mistaken for appendicitis, though the removal of the appendix did not relieve the pain.

Attention should be especially directed to chronic partial retention of urine as a result of chronic vesiculitis—a feature which seems to have escaped mention in the literature—though Fuller records a case in which he relieved acute urinary retention by incising the inflamed vesicle. I have observed probably a score of cases in which chronic retention of urine was abolished entirely by treating a chronic pus infection of the vesicles.

*Treatment.*—To the recognized methods of treatment I have

only one addition to recommend—the direct medication of the seminal tube and vesicle by injections through the vas deferens, which is opened for that purpose through a short incision in the scrotum—a method described in my contribution to the Transactions of this Association for 1906. This operation I have now made ninety-seven times on seventy-six patients, both vasa being injected in twenty-one patients. This can be done in the office under local anæsthetia, without subsequent confinement of the patient to the house.

In the more severe cases, the vesicle should be incised from the rectum, washed out and packed. This operation is facilitated by the preliminary opening of the vas; for the injection of the vesicle from the vas distends this sac, making its recognition and fixation less difficult. The treatment of the seminal duct and vesicle in this way seems to have opened a large and unexplored field, both diagnostic and therapeutic.

It may not be amiss to suggest that accurate diagnosis should precede this treatment, else many useless operations and needless disappointments are inevitable. For the relief of gonorrhœal and pus infections of the seminal tubes, irrigation through the vas, or irrigation combined with drainage from the vas through the vesicle into the rectum, is a valuable measure for those cases—and they are many—which prove refractory to massage and the other standard thereapeutic measures.

The chief technical difficulty arises from failure to anchor the vas while the scrotum is incised; if the vas escape from the incision, much difficulty may be experienced in recovering it. The prongs of a Berger tongue-holder, or of a double vulsellum, passed through the scrotum on either side of the vas, fix this slippery tube. It should be opened just outside of the inguinal canal.

The following are illustrative clinical cases:

Case 1. Man 47 years old, seen with Dr. Frothingham of Chicago. Has had symptoms of chronic cystitis for two years, without known cause. Latterly trouble has been more acute, causing confinement to bed for a week on several occasions, at which times complete retention of urine requiring catheterism has occurred. Prostatectomy has been urged and seriously considered.

Prostate was found swollen but soft, both vesicles swollen and tender, residual urine five to seven ounces; cystoscope shows some trigonum cystitis. Massage and other standard measures were advised and used for several months without permanent benefit.

November 15, 1906, both vasa were opened and injected under cocaine anæsthesia in my office; injections were repeated three times. Since December 15 he has had no trouble whatever in the urinary organs, and there is practically no residual urine.

CASE 2. Man 27 years old, referred by Dr. Lagorio in May, 1906. Had gonorrhœa seven years earlier, apparently cured in three months. Since that time he has had, at intervals of three to six weeks, attacks which often confined him to bed for several days. These have begun with urgent and frequent urination, with severe spasmodic pain in left loin and groin, sometimes extending into the testicle. With the abatement of these symptoms, pus usually appeared in the urine.

Patient has been treated for cystitis, and for renal colic; exploration of the kidney has been recommended, though the X-ray showed no urinary calculus.

The cystoscope and ureter catheter found nothing abnormal; the left seminal vesicle was swollen and tender. The usual treatment by massage, etc., was given for two months, during which time two attacks occurred. July 31, the left vas deferens was opened and the vesicle injected with berberine solution; the injection was repeated daily for four days, after which the lumen of the vas was restored. A mild attack of the usual sort occurred three weeks later, but none thereafter. Patient reported for inspection at intervals; during these nine months his genito-urinary organs have given him no trouble.

CASE 3. Man 58 years old, developed frequent and painful urination, followed a week later by severe pain in right iliac region, with high fever. Appendix was removed, without relief to urinary symptoms. Prostatectomy was proposed, but declined. Right epididymis swelled, after which pain in iliac region subsided.

When he came into my hands (June, 1906), he still had subacute symptoms of cystitis, with over an ounce of residual urine. Cystoscope showed no intra-vesical cause for his symp-

toms; but the right side of prostate, right vesicle, vas and epididymis were tender and thickened. An abscess in the epididymis was incised and drained; massage of the prostate, etc., was used for two months. His symptoms entirely disappeared.

This was a typical case of "pus tube" in the male, an example of a numerous class.

## DISCUSSION

Dr. HUGH H. YOUNG, of Baltimore, said this was a very important and interesting contribution. There was no question that the pathology and the treatment of the diseases of the ampullæ of the vasa deferentia had received too little attention, and too much importance had probably been at-

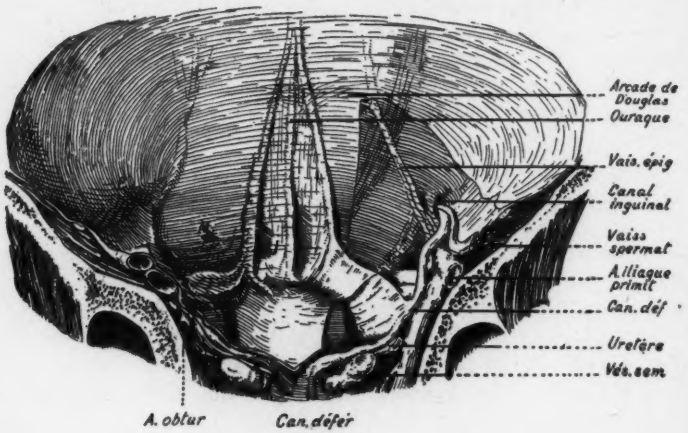



FIG. 3.

tributed to the seminal vesicles. He felt certain that he had had a great many cases that had been put down as chronic seminal vesiculitis that were really chronic ampullitis, if that term might be used. The structure of the ampullæ was more complex and the drainage from them probably less satisfactory than from the seminal vesicles, and he felt sure that there was often a retention of a considerable amount of inflammatory products in them. Three years ago he was invited by Dr. Belfield to read a paper before this Association

PLATE V.—Presented by Dr. Hugh H. Young.

FIG. 1.

FIG. 2.

on genital tuberculosis, and he then reviewed the work of von Büngner, who had injected iodoformized oil into the vasa deferentia after epididymectomy and had shown experimentally that the oil thus injected would penetrate the vas, the ampulla and also the urethra. Dr. Young said he at that time mentioned a method which he had used in several cases of tuberculosis, illustrations of which he had shown, in which, after excising the epididymis, instead of covering the ligated vas in the suture of the wound as had been done by von Büngner, he brought it out into the groin so as to get continuous drainage. The results obtained in the few cases in which he had used that method were very satisfactory indeed. The drainage kept up for several days, sometimes for several weeks from the vas deferens in the groin, and apparently had been the outlet for pus pent up in the ampullæ or even the seminal vesicles, and relieved a great deal the tuberculous condition in the deeper portions of the tract. During the time that the vas deferens was left out in the groin he had

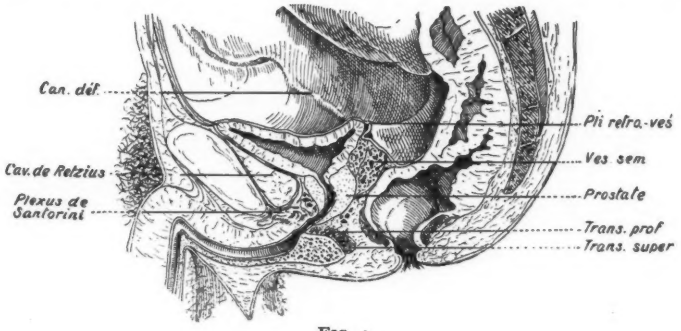



FIG. 4.

from time to time injected the seminal vesicles through this vas with iodoformized oil, in two cases with very very marked benefit. In one case complete retention of urine was produced by the injection of the oil into the vas deferens. It seemed probable that enough distention of the utricle had been produced to produce obstruction to urination. After one catheterization the patient had had no further trouble. He felt sure that Dr. Belfield was in a new field in his treatment of infections other than tuberculosis by means of injecting through the vas deferens, and in carrying this method of treatment into this other field he had done a very good deed and we owed him our thanks.

The accompanying illustrations were presented at that time. Fig. 1, showing the suture of the fascia around the vas deferens which was brought directly

out from the upper part of the inguinal canal; and Fig. 2., the closure of the skin around the vas, which was then injected with about 10 cc. of iodoformized oil. Figs. 3 and 4 showed the long course of the vas deferens around the bladder and beneath the peritoneum. Fig. 5 showed the terminal part of the vasa, the ampullæ, the seminal vesicles, the ejaculatory ducts and prostate, all of which are easily reached by this method. The anatomic plates were taken from Poirier.

Dr. EDWARD MARTIN, of Philadelphia, thought this contribution of Dr. Belfield's so illuminating that there should be more discussion of it. The point brought up as to the location of the inflammation after it left the urethra

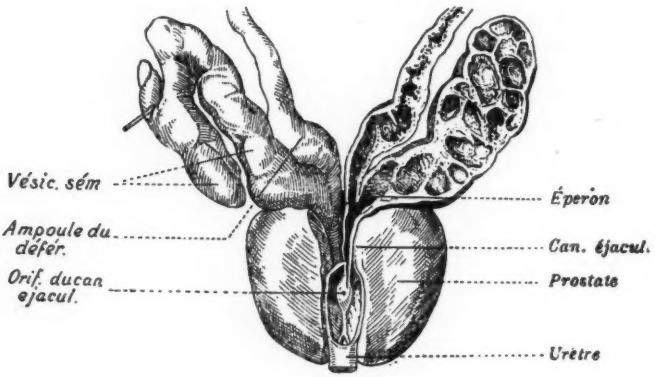



FIG. 5.

was an important one. He had never been able to determine by any ordinary clinical examination whether the greatest intensity of an inflammation was in the ampullæ or the seminal vesicles. The ampulla was capable of forming a tumor which would occupy the space, and even in the absence of a seminal vesiculitis it would give the symptoms of what was called seminal vesiculitis. He had often hesitated to adopt the radical and extensive operation of opening and draining the vesicles through the perineum, as it was quite a serious operation and entailed a stay of some duration in the hospital. Dr. Belfield had suggested a very good way of relieving the retention. The operation under local anæsthesia was a very safe one. Sometimes the condition might require the operation of deep perineal incision and drainage of the suppuration. He inquired whether Dr. Belfield found the vas dilated. The vas was often so

small normally that an ordinary filiform failed to penetrate it. It became quite large when obstructed. He asked whether there was any difficulty in entering the vas; whether there was any difficulty in keeping the opening in the vas patulous; whether Dr. Belfield had had any cases of descending infection from the site of operation. That should not be, because by the very fact of relieving the tension he lessened the danger of this occurring. It looked as though, perhaps, opening too low near the epididymis it might be possible that a descending infection would occur. Finally, he asked whether Dr. Belfield had in his experience found any cases of obliteration of the vas above his point of opening and between that and the major seat of infection, the base of the bladder.

Dr. BELFIELD said there were two or three gentlemen present who had been doing this operation with considerable success. As to Dr. Martin's questions: First, he had investigated with a great deal of interest the subject of stricture of the vas. He had never used bougies, because he could never get any bougie into the lumen of the vas. He had used horse hair threads, silkworm gut, and aluminum bronze wire, all of which had a sufficiently small diameter to enter most vasa. The silkworm gut was the largest, and sometimes had to be laid aside for one of the others. In three cases there had been a distinct obstruction somewhere within the pelvic part of the vas deferens, which he assumed to be a stricture, because attempts by the use of different threads to pass alike failed. Of course, he had no other proof that there was a stricture there. But in only three cases had it been impossible to pass one of these sounds clear up into the ampulla, a fact that was proven not only by the length to which the thread entered, but also because in two or three cases he had opened the vesicle from the rectum in cases of acute infection and had been able to run the thread right out into the rectum through the wound. As to the infection extending downward into the epididymis, that happened to him once. It was a case of rather acute pus infection, which had existed in a vesicle for a week before this little operation was done, and within twelve hours after the vas was opened the epididymis was evidently infected. He did not know whether the infection came through the wound that he made or whether it had already been present. As to keeping the vas under control, that was an easy matter if one did it right. He injected the vas every day, and then by simply pulling a thread the two cut ends of the vas were restored. When he first began to do the operation he made a transverse incision, later a longitudinal slit, both of which would give access for one injection. But what he was desirous of doing was to have the opening under control as long as he wanted to use it. He found he could not do that very well unless he divided

the vas so that he could lift it out of the wound whenever he pleased. A transverse cut was made through the vas. Sutures were passed, and the upper end of the vas lifted up into the skin wound. When no more injections were to be given, the threads were tightened and the lumen of the vas restored. The mechanical part of it was exceedingly simple and easy. The surgeon had absolute control of the lumen of the vas as long as he pleased. He had never kept the thread in position longer than ten days. He presumed the reason strictures occurred so seldom in the vas, in spite of frequent infection, was the same as the reason why strictures so very seldom occurred in the prostatic urethra. The vas, like the prostatic urethra, had very little subepithelia connective tissue; the great mass of the vas was unstriped muscle fiber, as in the prostate, and it was quite possible that the contraction of the vas emptied out the pus above and below. Certainly it was interesting that in only three out of ninety-seven vasa that he had sounded had there been what was apparently a distinct obstruction; although all of them had been more or less infected. The really interesting thing about this matter was the matter of diagnosis. As he looked back, and he did not have to look back so many years either, he could see so many cases where he absolutely failed to recognize the location of the difficulty, where he treated men for prostatitis and cystitis, washed their bladders, made instillations into their prostatic urethras, and did all the regulation stunts, without any suspicion that all the trouble was outside the prostatic urethra and that it was in the seminal vesicle and in the ampulla, until probably a week later the man would develop an acute epididymitis. These cases had been numerous. He believed if we would turn a little more attention to them than we had been doing we should find such cases exceedingly common. We all recognized the acute gonorrhœal infections outside of the urethra, and also the tuberculous infections, but these infections which were neither, and which came on suddenly, without any apparent provocation—cases of elderly men who suddenly developed an acute cystitis, as it was called, and then a few days later a suppurating epididymitis which had to be opened—had not been given sufficient attention, and their cause had not been recognized. At any rate, speaking for himself, he had not recognized them until within the last four or five years.

Dr. MARTIN thought this question was so important that he would like to hear from the men who had practiced Dr. Belfield's operation. He had split the vas longitudinally, but could not keep it open. He wished to know as to the ultimate disposition of these vasa, whether they were sutured or not.

Dr. FRANCIS R. HAGNER, of Washington, D. C., said he had used this method of treatment in one case, a case of acute gonorrhœal epididymitis

with an acute seminal vesiculitis. He did his operation for acute epididymitis, and at the same time injected a solution of argyrol into the vas deferens. The patient had a marked swelling of the seminal vesicle on the affected side before the operation. He was only given one injection, and within twenty-four hours the swelling was very much lessened, and on manipulation the pain was much less.

Dr. LOUIS E. SCHMIDT, of Chicago, has had experience in probably over twenty individual cases. In some instances the operation was done on both sides. Most of the cases were in elderly individuals, whose troubles, he was sure, at an earlier date would have been diagnosticated and operated on as some prostatic condition. Their symptoms and records of frequency of urination, the condition of their urine, and so on, closely simulated prostatic hypertrophy with cystitis. However, since Dr. Belfield had called attention to it, these cases and also the patients complaining of seminal vesiculitis had been looked into a little more carefully. He had in mind three instances particularly where a double operation had been performed, the first one somewhere about five months ago, the last within six or eight weeks, where on examination of the seminal vesicles pus could be expressed, and according to the rectal examination probably both seminal vesicles were involved. It was necessary in these instances to be absolutely certain to operate on both sides. As to the technique in these cases, he said he had used blunt platinum needles, they being introduced into each vas and sewed in place, so that a portion of the needle protruded from the wound which was to be connected daily with the syringe. These he had left in place from one to three weeks, depending on the condition of the patient, particularly considering his urine, urinary symptoms and the pain in and about the perineum. The needles were sewed in tightly and firmly, so that they would remain in place with the patient up and about. Most of these operations were done during office hours, and the patient allowed to walk away with the needles in place. They were expected to come to the office daily, and injections of argyrol were made, usually from 10 to 20 per cent in strength. At the start small quantities were introduced, from 5 to 10 cc., later from 20 to 30 cc., at one time. Immediately following the injection the argyrol would usually appear at the external urethral orifice. If the argyrol appeared then or at the time of urination it did away with the unnecessary examination of sounding in order to find whether a stricture in the vas was present or not. It showed that at least one side was patent. In these three cases mentioned he had had the patients under observation for some one or two years. He had hesitated to advise major operative interference, and finally operated in this way. These three patients were now un-

questionably free from all of their symptoms of frequency of urination, particularly at night, and their urine was absolutely clear. Of course, it was necessary to watch them for a longer period of time to state absolutely whether they would remain that way or not.

Dr. E. E. KING, of Toronto, confessed he had never had the courage to try this operation, for fear of setting up a condition worse than the one he had started to cure. It had seemed to him that after placing a ligature through the vas deferens and leaving it there a number of days there must be an inflammation set up, and when the attempt was made to restore the vas it would be occluded, and that there would be a permanent obstruction which would require a subsequent operation to restore the vas to its normal condition for the passage of semen. Probably the experience of these gentlemen had been that this would not be the result, and he might change his views regarding the operation. But it did not appear to him that we could be sure of restoring the tube in its continuity when the incision was closed. At the present time he was engaged in some experiments in the opsonic treatment of these inflammatory conditions, and he had four cases that had responded to that treatment. One of these patients had had only seven injections and three others five, yet they had received great benefit. He hoped to make a report at the meeting next year.

Dr. BELFIELD said the possible occlusion of the vas deferens by this operation was, of course, a matter that came into consideration very early, and yet so many men during the last ten years had shown that the vas could be divided and reunited with permanent restoration of its lumen, that it did not appeal to him as a thing to worry over. Nevertheless, none of them had used just the method that he used, of running the thread through and tying it in, and therefore, as Dr. King suggested, that might cause a trauma that had not been caused by any of the well-known methods of suturing the vas employed heretofore. He first worked it out on dogs, and then, fortunately, he had a human subject that was admirably adapted to decide the question. That man had lost one testicle before he came into Dr. Belfield's hands. He acquired another gonorrhœa, and came with the greatest concern, fearing he would lose the other testicle. He was therefore ready to have anything done that would save his testicle, and inasmuch as he already had evidences of an extension of the infection into the deeper parts, Dr. Belfield felt justified in opening the vas, injecting the vesicle and running a thread through and tying it in the usual way. That was done, and he recovered from the gonorrhœa in fairly good time. He had only one seminal duct, and he was good enough to bring semen ejaculated at different intervals for some eight or nine months

after the operation. Some of the specimens were fresh, and the spermatozoa were actively motile, while some of them were older; but all of them had plenty of spermatozoa. So that in that one case it was certain that no occlusion of the vas occurred within nine monhs after the operation. What might happen in the future he did not know. He thought that matter so well settled by work prior to this matter by different men that we would consider it as a fact that there was no danger of occluding the vas from simple division, and from suture, even months after the division had occurred. The question was as to leaving the thread in the vas for a week or two, and that did not seem a reasonable cause for stricture, when we compared it with what we knew of the clinical experience with the urethra. We do not hesitate to leave a soft rubber catheter in the urethra for weeks, or months, removing it for cleansing, and yet we knew that no stricture followed that. It seemed to him that the vas might be treated in the same way, with a great deal less chance of damage, because, as he had said, the vas was seldom the seat of stricture, the reason being, no doubt, the anatomical construction, there being very little subepithelial connective tissue. He did not think the possibility of occlusion of the vas could enter into this problem at all.

## MODERN OPERATIONS FOR COMPLETE REMOVAL OF THE PROSTATE

By Arthur Tracy Cabot, A. M., M. D., of Boston

Consulting Surgeon at the Massachusetts General Hospital

At the present time two methods of complete prostatectomy are being urged by earnest advocates: one is the suprapubic method and the other the perineal; both of these methods usually permit of thorough removal of the prostate.

The choice between them should be based on the relative mortality of the operation, the quickness of recovery, and upon the degree of restoration of function obtained by each.

In order to decide these points and make a wise selection between these operations, it is therefore important to assemble statistics which shall give us reliable data both as to mortality and as to after condition.

Something is also to be said in regard to the technical difficulties which surround each operation.

I operated first by the suprapubic route, because it was an easy method of approach to the gland requiring but little dissection. Since, however, I began to use the perineal operation I have gradually used it more and more and I now find that I regard it as the method of choice and I apply it to every case in which the removal of the prostate is the prime object of the operation.

This change of practice has come about because I have found that although it takes a somewhat longer dissection to reach the prostate by the perineal route, the opportunity for accurate inspection and exact operative procedure is so much better as to wholly outweigh the added difficulties of the dissection.

Some operators consider it of no consequence whether the prostatic urethra is torn much or little during the operation. The fact that good results are obtained when all of the urethra within the prostate is torn out with the gland leads many to think that it matters little what happens to the prostatic urethra anyway.

I cannot share this view, for I believe that when the prostatic urethra is for the most part preserved in its proper relations. not only is the healing and restoration of the parts more speedy, but the chance of satisfactory restoration of function is more sure.

Young has cited facts to show the retention of sexual power when the utricle and seminal ducts are spared. I believe that the restoration of satisfactory urination is more sure when the prostatic urethra has not been seriously torn.

One cause for lack of success in complete prostatectomy has been from the formation of flaps of mucous membrane which have afterwards acted as valves to hinder urination. These flaps form in two places: at the vesical outlet and at the apex of the prostate where it joins the membranous urethra.

If the prostate is enucleated from above, the mucous membrane is broken through with the finger at the vesical outlet and through this opening the gland is stripped out. Working from above downwards, it must not infrequently happen that a portion of the urethra towards the apex of the prostate is left, while the portion of the urethra towards the bladder is thoroughly removed. This part of the urethra which is left projects back into the cavity from which the prostate has been shelled out. It forms, as it

FIG. 1.—Diagrammatic drawing, showing above, a flap of mucous membrane left by shelling out a prominent third lobe, and below, a remnant of the urethral mucous membrane extending back into the cavity from which the prostate has been removed—either of which would tend to form a valvular closure of the urethra.

PLATE VI.—Presented by Dr. Arthur T. Cabot.

were, a cuff. It may be readily seen that with the current of urine flowing down from above, this cuff of mucous membrane, by folding from side to side, may readily close the opening of the urethra as an obstructing valve.

Operating through the perineum with a wide incision, which allows the parts to be brought into view, the various steps of the operation are under the guidance of the eye, and the difficulties above described are easily avoided.

The enucleating finger entering at the apex of the prostate separates the gland from its outer capsule, then from the vesical side, and lastly strips it off from the urethra. This separation of the gland from the urethra is done from within outwards, can be assisted by the scissors and blunt dissector and preserves the urethral wall for the most part.

Up to this stage of the operation the only damage done to the urethra has been the opening through which the tractor was introduced, and usually some tearing of its floor. The roof of the urethra is left intact. There is no cuff of mucous membrane which can roll in and form a valve.

In a difficult case when the urethral wall is torn more than is usual the rent is so disposed that any flap that is formed is attached about the orifice of the bladder so that the urine as it flows out does not double it up in front of the stream, but rather washes it out flat and escapes by it.

If now there is a third lobe which has a broad base, it can be readily removed through the cavity left by the removal of the lateral lobes.

If a very prominent third lobe is peeled out without removing the mucous membrane covering it, a large loose flap is left which may act as a valve and obstruct the vesical orifice just as the third lobe itself did.

When there is a pedunculated third lobe I prefer therefore to pull it out from the urethra and to cut it off with the thermo-cautery, removing its mucous membrane with it.

In some cases there are several projections into the bladder, all of which can be dealt with in the same manner.

By cutting off these pedunculated outgrowths *in toto* we avoid the formation of flaps of mucous membrane, which may afterwards act as valves. The vesical opening left after the re-

moval of the lateral lobes is ample for the handling of a good-sized third lobe.

I have found the lithotomy scoop a useful instrument in pulling down these projecting growths and have never been seriously hampered by want of room to properly deal with them.

Three times in the past three years I have encountered small obstructing prostates which could not be enucleated. One of these I approached from above and, finding a bar at the neck of the bladder, I cut and cauterized it as deeply as seemed safe with so small a prostate. This operation was followed by but little improvement.

The other two cases I treated by perineal prostatectomy. Finding that the glands would not peel out I cut them out piecemeal with rongeur forceps, and then with a finger as a guide in the bladder I cut away the bar bit by bit till nothing was left but soft mucous membrane. In both of these cases the restoration of urination was thoroughly good.

My personal experience, then, has been that the restoration of function is more complete and lasting after the perineal than after the suprapubic operation.

The control of hemorrhage I have found distinctly easier by the perineal route.

A strip of gauze can be snugly packed into the prostatic capsule and then the end can be brought down through the outer wound, which it should not fill tightly, for too much pressure against the rectal wall may produce sloughing and lead to a fistula.

In the suprapubic operation it is difficult to apply packing so that it will stay in place and continue to exert pressure against the bleeding surface without so filling the base of the bladder as to exert injurious pressure on the ureters and to cause great discomfort to the patient.

In one case of suprapubic prostatectomy I had great difficulty in controlling the hemorrhage and lost my patient owing, as I thought, to the interference with the kidneys caused by the tight packing.

Convalescence after perineal prostatectomy is much quicker and more comfortable than after the suprapubic operation.

The tubes can be removed on the third to the fifth day, and after this the patient soon passes his own water with little or no involuntary leakage. At first the larger part of the water comes through the perineal wound and serves the good purpose of keeping this thoroughly washed out. Occasionally, for a few days, the urine comes away involuntarily through the perineal wound. This soon ceases, however, and usually by the end of a fortnight the greater part of the urine is passed *per urethram* with little or no escape through the perineum.

It has happened in one or two of my cases that after taking out the tubes the patient has been unable to void the urine. In these cases the catheter is easily introduced through the urethra and drainage kept up for a few days in this manner, at the end of which time the power of voluntary urination has been invariably restored.

In some few cases the patients preferred to have the catheter retained till the tenth or twelfth day on account of the comfort of keeping the dressings dry.

The in-lying catheter does not interfere with getting the patient out of bed, and it is our practice to get them up as soon as possible, for they seem to do better when moving about.

*Mortality.*—In the past four years I have operated on thirty-five cases by perineal prostatectomy.

Two cases have died; one three days after operation, the other at the end of a month.

The histories of these two fatal cases are as follows:

CASE 14. E. F. S., aged 77. Entered the hospital March 26, 1905, with a history that he had been for ten years troubled with frequent urination.

Four weeks before entrance he began to feel as if he did not empty the bladder.

Three weeks ago the urine stopped. He then resorted to the catheter, which has been used ever since.

Two days ago he began to have difficulty in using the catheter and he has now gone fourteen hours without having any urine drawn.

The greatly distended bladder was emptied and constant drainage was instituted.

At the time of entrance the urine was 1,027 specific gravity

and showed a trace of sugar. Quantity of urine was only 19 ounces in the first twenty-four hours; the next twenty-four hours it rose to 35 ounces; and six days after entrance it rose in twenty-four hours to 85 ounces, falling back, however, to 55 and 42 on the following days.

The patient was troubled with bronchitis of a chronic nature. Operation was put off in the hopes of somewhat improving this condition. However, his condition was so uncomfortable and manifestly getting worse that operation was undertaken on April 11.

In cutting into the prostate considerable pus escaped and was pressed out during the subsequent enucleation.

The patient made a good recovery from ether, but on the following day the temperature rose to 101 and at night reached 103. The quantity of urine in that twenty-four hours was 20 ounces and the specific gravity 1,018.

On April 13, the temperature remaining up, the patient showed cyanosis, and rales were found at the base. The quantity of urine in this twenty-four hours rose to 40 ounces and contained 1.3 % sugar.

On the 14th the patient became unconscious. The quantity of urine rose to 90 ounces, with 3 % sugar, and having a specific gravity of 1,028.

The patient died in the afternoon, and unfortunately an autopsy could not be obtained.

Case 15. P. P., aged sixty-one. Entered the hospital April 10, 1905.

At time of entrance the patient was stupid and urine was tinged with blood. Patient said that he had always urinated well till five weeks ago, when he was seized with acute retention and catheterized. Since that time he has dribbled his urine in small quantities, with an occasional catheterization.

At the time of entrance the bladder extended above the umbilicus and the catheter introduced drew 40 ounces without emptying the bladder. Three hours later, 20 ounces were drawn, and in the evening of that day he was placed on constant drainage.

Two days after entrance, the quantity of urine was 100 ounces in the twenty-four hours, specific gravity being 1,010.

On April 20, perineal prostatectomy was done, following

which he passed 100 ounces of urine, with a specific gravity of 1,017.

After this the quantity of urine fell till, on April 24, it was 50 ounces in twenty-four hours, with a specific gravity of 1,018.

He now became flighty in his mind, pulled out his tube, and had a catheter introduced through the urethra. He was gotten out of bed, thinking that this might improve his condition, but, although the quantity of urine became fairly good, he gradually became more and more feeble and died on May 18, one month after operation.

The symptoms in this case were somewhat difficult to understand, and a neurologist who saw him in consultation thought that his condition indicated a previous apoplectic seizure, which had left some mental deterioration.

CASE 14. The first of these patients with chronic bronchitis and glycosuria well illustrates the condition of broken health in which many of these patients come to the surgeon.

CASE 15 did not die as an immediate effect of the operation, but from some toxæmia, as I thought, originally due to the obstruction in the prostate with its secondary effects on the kidneys. In both cases, however, the operation failed to keep them alive and they should be rated in the mortality risk.

They give a death rate of 5.5 % in this small series of cases.

This is somewhat higher than the mortality rate in the statistics of some operators, and higher, I believe, than the normal risk of the operation.

I have now had twenty-one successive recoveries due in part doubtless to increased skill in operation and to experience in after treatment.

Young reports sixty successive cases without a death.

In no one of the thirty-three cases that recovered was there a failure to restore the power of voluntary urination, and in no case was there incontinence.

In one case (Case 8) the bladder was distended by 83 ounces of urine when he came under treatment.

At first after operation the residual urine was 17 ounces; it had fallen to 5 ounces one month later. He was then lost sight of. He had been freed from the constant thraldom of the catheter,

but found its occasional use of advantage in keeping the bladder clean.

CASE 9 had a residuum of 15½ ounces before operation, and one month after operation was passing urine with a little discomfort and had a residual urine of from 4 to 6 ounces; he was then lost sight of.

It is to be remembered that in many cases of prostatectomy the full measure of improvement is not reached for several months.

From these cases and from others I have received the impression that a certain proportion of these patients whose bladders have been long distended lose the expulsive force to such a degree that they are afterwards unable to completely void the urine even when the obstruction is wholly removed. This is due not only to the induced atony of the walls, but also to the sacculation which forces portions of the mucous membrane out between the muscular bundles so that the sacculi have no contractile tissue in their walls, and so are unable to empty themselves when the bladder closes down.

It remains to speak of my experience with rectal injury, which is constantly urged as an opprobrium of the perineal operation.

In Case 5 the vigorous traction of a retractor tore a rent about an inch long transversely across the rectal wall. It was closed with a double row of chromic gut stitches and healed by first intention without causing any trouble.

Since that experience I have always covered the rectum with the end of a gauze sponge beneath the retractor, and have found this a perfect protection.

In Case 17 an old and broken man of 78, who had had a partial prostatectomy by the suprapubic route eight years before, was greatly troubled by a persistent suprapubic fistula. For six years he passed water unsatisfactorily by the natural efforts, but for two years he had returned to the use of the catheter. In the hope of relief from his fistula he decided upon further operation.

The effect of the former operation seemed to have been to fix the prostate rather high in the pelvis, so that it was more than usually difficult to reach from the perineum. The hemorrhage was no more than it often is, but the already feeble condition of the patient caused apprehension on this score, and after he was

in bed an extra gauze was packed into the outer wound. The pressure of this led to a slough in the rectal wall which caused a fistula that was slow to heal and greatly prolonged the convalescence. Voluntary urination was re-established and the suprapubic fistula closed, but there continued to be a considerable leakage into the rectum.

In both of these cases the injury to the rectum was due to lack of experience on my part, and in both cases the difficulty was preventable.

*Preparatory Treatment.*—It often happens that these patients reach the surgeon in a condition very unfavorable for operation. The two fatal cases illustrate this. Other cases which seemed equally unfavorable were so improved by preparatory treatment as to bear the operation perfectly. Case 25 was an example of a severe cystitis, with probably pyelonephritis, and certainly uræmia, who required one month of preparation before operation could be safely undertaken.

Case 25. Mr. F., 63 years of age. Seen by me May 11, 1906. For two years he had had increasing frequency and difficulty in urination. Six weeks before I saw him the difficulty of urination had greatly increased and required the constant use of a catheter. For several days he had had fever and nausea. He was of feeble muscular development though he had had but little illness during his life.

Examination showed him to be mentally confused, with a feeble, irregular pulse, a dry, brown tongue, anorexia and persistent nausea.

The bladder could be felt moderately distended and the prostate was smoothly and evenly enlarged. The catheter passed easily and drew about a pint of very cloudy urine, and at the end about 2 ounces of pus flowed out. The catheter was fastened in for constant drainage. Liquid diet with as much water as he could comfortably take.

First twenty-four hours, 60 ounces of urine, much clearer than had been drawn at entrance. Specific gravity, 1008; albumen, trace; urea, 19 grammes. The urine quickly increased in amount up to 120 ounces, and his power of taking food improved, but slight occasional nausea with a dry tongue persisted for a long time.

Finally at the end of a month, during most of which time the amount of urine had remained above 100 ounces, the tongue cleared off, the pulse became steady at about 70 and perineal prostatectomy was done.

*Pathological Report.*—Glandular hypertrophy with retention cysts.

Convalescence was slow but steady.

This patient was up in five days, but the wound healed very slowly.

Reported in November: "Passes water four times in day, once in night. Feels like a boy."

CASE 12 was an instance of glycosuria which was so improved by treatment that a prostatectomy was well borne.

The accompanying table gives the essential details of this series of cases.

## DISCUSSION

Dr. HUGH H. YOUNG, of Baltimore, said that Dr. Cabot's idea in regard to the capsule of a pedunculated median lobe was probably correct. He was brought to that conclusion a year or two ago by the fact that one of his patients passed, three weeks after operation, a slough consisting of the capsule that had been left behind. The middle lobe in that case was as large as an orange. Since then he had seen one or two other cases in which he thought a flap-like capsule produced obstruction, and he thought it advisable in such cases to excise the capule along with the lobe. The objection was that there was more hemorrhage, and Dr. Cabot's plan of using a cautery on that account seemed advisable. The use of the finger in getting out small median bars was very important. He had used it for quite a while now, and with very great help. Dr. Young said he had never had to remove the prostate piecemeal, even in fibrous cases, and he thought the reason was that he made the lateral incisions very deep. He almost completely divided the prostate on either side in these fibrous cases. If you separate the lateral lobes from the urethra in that way by incision, the separation from the capsule was very easy with blunt dissection. It would nearly always out in one piece. The median portion was often so fibrous that scissors were necessary, but as a rule it could first be partially enucleated with the blunt dissector or sharp periosteal elevator.

Dr. L. BOLTON BANGS, of New York, wished to contribute a word to the experience on this subject. He had had an instructive experience in this

SUMMARY OF CASES

| No. | Age | Name | Residence | Duration | Amt. of obstruction | Date of op. | Result | Pathology | Condition after recovery |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 64 | E— | Medford, Mass. Hospital case | 3 years | Catheterized himself every 4 hours | Feb. 1904 | Recov. | Glandular hypertrophy | Six mos. later urinates ev. 3–4 hours. "Feels a new man." No residual. Mar., '05, same report |
| 2 | 73 | C— | Everett, Mass. Hospital case | 3 weeks | Depends entirely on catheter since first attack | Feb. 1904 | Recov. | Glandular hypertrophy | Mar., '05, all urine per urethra. Resid. 2 drams |
| 3 | 56 | S— | Amesbury, Mass. Hospital case | 7 years | Depends on catheter entirely, Litholapaxy 3 days before operation. | Feb. 1904 | Recov. | Hypertrophy of glands | Mar., '05, no resid. Better than for 20 years. Perfect control |
| 4 | 54 | N— | Dover, Mass. Hospital case | 7 years | For 2 years urine dribbled. Bladder distended to umbilicus | Mar. 1904 | Recov. | Glandular hypertrophy | One month later no resid. |
| 5 | 65 | M— | Boston, Mass. Private case | 1 year | Resid. 8 oz. in 1903. Later depended wholly on catheter | Mar. 1904 | Recov. | Diffuse hypertrophy. Small prostate | In 1907 good health. Passes all urine naturally. Resid. in 1906, 2 drams. |
| 6 | 68 | C— | Haverhill, Mass. Hospital case | 2 years | 2 years ago, frequency ev. 3 hours, now ev. 10 or 15 min. | Apr. 1904 | Recov. | Glandular hypertrophy | May, '05, very well since op. |
| 7 | 71 | H— | Milford, N. H. Private case | 3 years | Frequency 21 times in 24 hours. Blad. distend. above umbilicus | May 1904 | Recov. | Glandular hypertrophy with cystic dilatation | 4 mos. later residual 2–2½ oz. |
| 8 | 72 | L— | Cambridge, Mass. Hospital case | Few weeks | Apr. 23, abdomen dis. to umbilicus. 83 oz. drawn by catheter. Constant drainage. | May 1904 | Recov. | Glandular and cystic hyperplasia | Urination restored. At first, resid. 17 oz. 1 mo. lat. fell to 5 oz. At that time used cath. once a day |
| 9 | 53 | V— | Cambridge, Mass. Hospital case | 11 years | For 6 months used cath. once a day. Resid. 15½ oz. | May 1904 | Recov. | Simple hypertrophy | One month later passing urine with very little pain. Residual 4–6 oz. |
| 10 | 71 | R— | Haverhill, Mass. Hospital case | 12 years | Urinates ev. hour or less in day, 1 to 3 hours at night | May 1904 | Recov. | Glandular hypertrophy | Last of July, better than for yrs. No residual. June, '05, much improved, perfect control |
| 11 | 57 | F— | Haverhill, Mass. Hospital case | 2 months | 11 days ago stoppage. Since cath. twice a day | Jun. 1904 | Recov. | Glandular hypertrophy | Seen in Sept. Very well. Urination normal. June, '05, symptoms all relieved |

SUMMARY OF CASES—*Continued*

| No. | Age | Name | Residence | Duration | Amt. of obstruction | Date of op. | Result | Pathology | Condition after recovery |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 65 | G— | Hospital case | 8 years | Glycosuric. Past mo. dependent on cath. 10 days ago could not introduce cath. Const. drainage | Feb. 1905 | Recov. | Chronic glandular hypertrophy | Apr., '06, well since op. Urin. ev. 4 h. Once at night. Resid. 2 1-2 oz. Sugar intermittent, now quite 1% |
| 13 | 60 | G— | East Dedham, Mass. Hospital case. | 10 years | Occasional use of cath. for retention. Entirely last 2 mos. | Feb. 1905 | Recov. | Glandular hypertrophy | Calculi removed. Mar., 1906, no difficulty. "Never felt better." M. G. H. |
| 14 | 77 | S— | Hyannisport, Mass. Hospital case | 10 years | Dependent on catheter for past 3 weeks | Apr. 1905 | Died | Glandular hypertrophy | Sugar found in small amt. Passed 90 oz. urine. No autopsy. M. G. H. |
| 15 | 61 | P— | Roxbury, Mass. Hospital case | 5 weeks | 5 wks. ago acute retention. Cath. sev. times since. Abd. much distended | Apr. 1905 | Died | Glandular hypertrophy | Died 1 mo. later of pneumonia. M. G. H. |
| 16 | 64 | C— | Cambridgeport, Mass. Hospital case | 5-6 yrs. | Uses cath. 3 times daily | Jun. 1905 | Recov. | Adenoma | Jan., '07, died of "heart failure." Had no trouble with urination since op. M. G. H. |
| 17 | 78 | H— | Haverhill, Mass. Hospital case | 10 years | Suprapubic op. in '97. Has used cath. for 2 years | Oct. 1905 | Recov. | Cystic Adeno. | Urination restored. M. G. H. |
| 18 | 64 | C— | Boston, Mass. Private case | 16 years | Occasional use of catheter. Residual 1 1-6 oz. | Nov 1905 | Recov. | Glandular hypertrophy c retention cysts | Jan., '06, feels well. Urinates ev. 1½ to 2½ hrs. Residual ½ oz. |
| 19 | 62 | P— | Hudson, N. H. Private case | 15 years | For year used catheter 1–3 times at night, once in day. | Dec. 1905 | Recov. | Adenoma | July 30, '05. ½ oz. "Feels 100% better since op." |
| 20 | 69 | M— | Rockland, Mass. Private case | 10 years | Residual 3 oz. | Jan. 1906 | Recov. | Adeno-fibroma c cystic formation | No residual |
| 21 | 61 | C— | Harwich, Mass. Hospital case | 7–8 yrs. | Acute retention 2 days ago. Bladder distended fr. umb. to pubes | Apr. 1906 | Recov. | Cystic Adeno. | 1 mo. after op. residual ½ oz. Urination normal. |
| 22 | | S— | Boston, Mass. Private case | Many yrs. | Stream always sluggish Resid. 8 oz. | Apr. 1906 | Recov. | Glandular hypertrophy | Urination normal. No residual |

SUMMARY OF CASES—*Continued*

| No. | Age | Name | Residence | Duration | Amt. of obstruction | Date of op. | Result | Pathology | Condition after recovery |
|---|---|---|---|---|---|---|---|---|---|
| 23 | 66 | A— | Dorchester, Mass. Private case | 6 years | Resid. 3 1-2 oz. Urinates once an hour in day, only twice at night | Apr. 1906 | Recov. | Glandular hypertrophy | June 23. No residual |
| 24 | 60 | S— | Cambridge, Mass. Hospital case | 1 year | Apr. 13, stoppage. 50 oz. by cath. Cath. most of time since. Residual 8 oz. | May 1906 | Recov. | | |
| 25 | | F— | Peabody, Mass. Private case | 2 years | Increasing freq. and dif. in urination. Worse past 6 weeks requiring catheter | Jun. 1906 | Recov. | Glandular hypertrophy | June, '07. Urinates 4 times in day, once at night. "Feels like a boy" |
| 26 | 64 | W— | Waltham, Mass. Private case | 3 years | Residual 3 oz. Frequency ev. hr. or two during day | Nov 1906 | Recov. | Cysto-adenoma | No residual. Reported in June, feeling very well, with no discomfort whatever about urination |
| 27 | | P— | Brighton, Mass. Private case | 3 years | Residual 2 oz. Urinates with difficulty ev. 2 hrs. Sev. attacks of inflammation with great discomfort | Nov 1906 | Recov. | Gland. hyperplasia c retention cysts | Seen in June, '07. Was perfectly well. Passing water normally. Regarded himself as greatly benfited by operation |
| 28 | 70 | L— | Brighton, Mass. Private case | | For 20 years slowness of stream. Of late, worse and required cath. twice a day. Residual 30 oz. | Nov 1906 | Recov. | Gland. hyperplasia c retention cysts | In excellent health. Free and comfortable urination, 5 or 6 times in 24 hours |
| 29 | 75 | O— | Neponset, Mass. Private case | 4 years | Wears a catheter all time | Dec. 1906 | Recov. | Glandular hypertrophy | June, '07. Urination easy and comfortable; 5 times in day, 3 at night. Has gained wt. |
| 30 | | W— | Peabody Mass. Private case | 1 year | Frequency every hour. Residual 15 oz. | Jan. 1907 | Recov. | Gland. hyperplasia c cystic dilatation | In good health. Comfortable urination. Not heard from |
| 31 | | F— | Westboro, Mass. Private case | 5 years | Residual 2 to 4 oz. Used catheter occasionally | Jan. 1907 | Recov. | Glandular hyperplasia | |
| 32 | 72 | H— | Maine. Private case | 15 years | For past 2 years used catheter chiefly. Residual 12 oz. | Feb. 1907 | Recov. | Glandular hypertrophy | April. Holds urine 6 hours. Feels better than for yrs. |

SUMMARY OF CASES—*Continued*

| No. | Age | Name | Residence | Duration | Amt. of obstruction | Date of op. | Result | Pathology | Condition after recovery |
|---|---|---|---|---|---|---|---|---|---|
| 33 | 65 | W— | Wellesley Fms., Mass. Private case | 10 years | Suprapubic in 1899. Dif. returned until dependent on cath., using 8 times 24 oz. | Mar. 1907 | Recov. | Glandular & fibrous hypertrophy | Apr. Resid. 3 1-2 oz. Urination ev. 5 hrs. in day, twice at night |
| 34 | 65 | C— | Brookline, Mass. Private case | 6 years | Bladder difficulty, catarrh, etc. Catheter twice a day | Mar. 1907 | Recov. | Gland. & fibrous hypertrophy | May Resid. less than 1 oz. |
| 35 | | W— | Tyngsboro, Mass. Private case | About 2 years | Increasing difficulty and occasional retention, requiring catheter | Mar. 1907 | Recov. | Glandular hypertrophy | June, '07. No difficulty in urination. No frequency in day, once in night |

last year in regard to the two classes of cases which Dr. Cabot had presented. Dr. Bangs said he was a great admirer of Dr. Young. He had great faith in his capacity for removal of the prostate, but he must confess, either because of his inexperience or lack of tactile skill, that he had found cases where it was utterly impossible to shell the prostate out. He had had to deliberately, patiently, piece by piece remove the prostate, and certainly all of its obstructing portions. Others, again, he had been able to shell out, and when that was possible it was a very comfortable sensation. Dr. Bangs appealed to his colleagues as to whether that had not been their experience. There were cases, however, in which it was impossible to shell the prostate out, and where it became necessary to remove the prostate piece by piece. He had had a recent case in which it was utterly impossible to deal with the conditions by means of the perineal operation. The obstructing portion was a prostatic outgrowth like a man's thumb. It acted like a ball-valve obstructing the greater portion of the outflow of urine. The man's bladder had become infected, and there was pyuria. It was necessary to seize the outgrowth with forceps and cut it off with the old-fashioned rongeur in order to make a success of it, so that by feeling he was conscious that he had lowered the exit from the bladder so that the man would have no further obstruction. He did not believe that that condition could have been treated by the perineum. The reason the operation was done by the suprapubic method was that the patient was brought to him *in extremis*. It was found that the man had two large stones, and the preliminary operation was all that he dared to do at the time. Drainage and upbuilding of the man brought him into a condition where the obstruction might be removed. At the suprapubic operation, which was done very rapidly, the condition was discovered, and he contented himself with operating later.

Dr. FRANCIS R. HAGNER, of Washington, D. C., said he had been doing Dr. Young's operation for four years, and he had had just the experience that Dr. Bangs had spoken of. He had made deep lateral incisions, but the portion adherent would be the portion of the prostate joining the capsule. He had had four or five of these cases that he could not enucleate at all, and it was necessary to remove the prostate piecemeal. There were great bands of connective tissue running through the prostate and attached to its capsule, and it was impossible to enucleate it. He mentioned a case in which he had done Dr. Young's operation. The man was cystoscoped, a median and lateral enlargement was made out. The middle and the lateral lobes were taken out. After the drainage tube was removed the patient failed to pass any urine at all. The patient was again cystoscoped, and there was found

a mass, a pedunculated portion of the upper or superior lobe that had been left behind. A suprapubic operation was done, with a good result. Dr. Hagner said he believed that if he had realized the danger of this portion of the prostate causing obstruction and had examined carefully at the time of operation he would have found out the condition and would have been able to remove it through the perineum. He thought it was very important to put the finger into the bladder after removing the prostate and see if anything was left.

Dr. JOHN H. CUNNINGHAM, Jr., of Boston, thought that the point brought up by Dr. Cabot regarding obstruction taking place in the prostatic region after removal of the gland was important, at least in connection with the rapid median perineal operation. He had performed rapid median perineal prostatectomy in twenty-four cases and in two instances had met with obstruction in the prostatic region. Both of these were cases in which sounds had not been passed following the operation. In one, urinary retention became complete. External urethrotomy was performed without a guide. The finger bored through the regenerated connective tissue until the bladder was entered. This patient had never had sounds passed following operation. The obstruction took place in about three months. The second case showed a constriction in the region previously occupied by the prostate, but returned before the obliteration was complete and the urethra was dilated up to the normal caliber. From Dr. Cabot's remarks and these cases, it seems to be evident that obstruction may take place in the region previously occupied by the prostate, and Dr. Cunningham suggested the importance of keeping cases of prostatectomy under observation for the passage of sounds until the urethra shows no tendency toward contraction.

Dr. JOHN VAN DER POEL, of New York, had had a case very similar to the one reported by Dr. Hagner, where the middle lobe was not made out at the time of operation—his first case. He had not in this case cystoscoped the patient. When first presented there was some residual urine,—about four ounces,—with frequent desire to micturate both day and night. The lateral lobes were removed by Dr. Young's operation, with a rapid recovery, although the frequent urination was still present. The patient went on, howvever, and refused further operation until two years later, when he was cystoscoped and a large middle lobe found. A secondary perineal operation was done, but it was found to be impossible to shell out the middle lobe, on account of its pedunculated condition, when it was simply dragged out and the entire mucous membrane covering it removed with it. The patient still had some frequency of urination, but no obstruction.

Dr. YOUNG said he wished to say just a word as to the point raised by Dr. Cunningham. He thought that where the urethra was preserved it was almost never necessary to pass a sound after a perineal prostatectomy. He had had but one case in which there was a stricture developed after operation, in a series of two hundred cases, and that was the case of an old man who had a very fibrous median bar—and he excised a portion of the urethra in that case. He thought that the preservation of the floor of the urethra was a very important point, not only to prevent the occurrence of stricture, but also of epididymitis and possibly of impotence.

Dr. CABOT, in closing, said he had on two or three occasions removed several of those vesical outgrowths. In one case he had removed four, one after another. They were all very easily hooked out with the scoop used in removing stones from the bladder. He always explored the whole vesical neck with his finger after operation and before putting in drainage.

## SPONTANEOUS FRACTURE OF STONES

By ARTHUR TRACY CABOT, M. D., of Boston

DR. ARTHUR T. CABOT showed two photographs of stones that had been spontaneously fractured in the bladder.

He said that while looking over the collection of calculi at the Norfolk and Norwich Hospital in Norwich, England, he had been surprised at the number of specimens of spontaneous fracture he found there.

He saw, he thought, about a dozen examples of this rare condition, and through the kindness of Mr. Ballance obtained photographs of several characteristic specimens.

The stones of which he showed the photographs were in both cases obtained at autopsy from bladders which had not been subjected to instrumentation.

Englisch, in a recent article on spontaneous fracture, drew the following conclusions:

1. Spontaneous fracture is a characteristic of uric acid stones or of combinations of uric acid with other salts. In stones of other constituents spontaneous breaking up takes place only from

without inwards through solvent action and the fragments do not have the described characteristics of true spontaneous fracture.

2. Oxalates often break spontaneously; but never show regularity in their fragments.

3. The possibility of spontaneous fracture as well as the form of the fragments is due to the arrangement of the crystals of the component elements in the building up of the stone, and the smallest stones show the segmentation and the segmented form of the fragments is their most important characteristic. This arrangement is apparent in artificial stone formation and in thin sections of the smallest stones.

4. The nucleus of uric acid stones is always separated from the other layers by a loose layer of urate of ammonia or by mucous fluid, so that on section it readily falls out. From this layer radiating processes extend toward the periphery in form of radiating furrows.

5. Spontaneous fracture takes place almost exclusively in the bladder, since it occurs in the renal pelves and ureter in only exceptional cases.

6. Spontaneous fracture is usually found in stones that are rubbed down by friction.

7. Mechanical agencies can cause a breaking up of a stone only when the radiating rifts and ridges are highly developed, so that the segments are divided from each other by broad furrows and are held together by masses of mucus or phosphates lying in the rifts. The force required is always considerable.

8. Chemical action as a factor may be explained through the solution of the substances in the furrows and rifts or through changes of volume. To allow of which it must be supposed that all or some of the rifts reach to the surface of the stone and are immediately exposed to the urine in the bladder.

9. The best explanation of spontaneous stone fracture is given by the afore-mentioned chemico-mechanical theory. It works from within outwards through solution of the binding substance and the changes of volume thus brought about or through gas formation.

10. The full elucidation of this question demands further study of stones freshly taken from the bladder.

PLATE VII.—Presented by Dr Arthur T. Cabot

FIG. 1.—Spontaneous fracture of stone. The angular fragments probably formed originally an outer crust for the nucleus, which afterwards accumulated another outer crust which is now in turn splitting off.

There is nothing new in these conclusions of Englisch, but they bring together in compact form what is known on the subject.

Previous observers, Ord and others, have shown that spontaneous fracture is apt to take place in a urine which, having been concentrated, becomes very dilute. It seems as if this extremely dilute urine, penetrating into the stone along these rifts or radiating striæ, dissolves the more soluble parts of the stone, frees the less soluble parts, and they break apart in the forms shown in the photographs.

This action of very dilute urine probably accounts for the breaking up of a stone sometimes occurring while the patient is drinking a so-called lithia or other spring water.

Englisch's first conclusion, that spontaneous fracture is a characteristic of uric acid stones, did not seem to be borne out by the appearance of some of the stones seen in Norwich. Without a chemical examination of these stones it is impossible to speak positively, but in several of the most beautiful examples of spontaneous fracture, the fragments were white in color and had all the appearance of being composed of carbonates and phosphates.

The photograph here reproduced represents a specimen which illustrates in a unique manner the various steps in stone segmentation. The smaller pieces have the wedge-shaped forms characteristic of spontaneous fracture. Their rounded edges produced by friction and by deposition after they were separated, show their comparative age.

The larger stone in cross section shows the crust which surrounds the nucleus splitting off again in characteristic forms.

The rifts along which this separation takes place are clearly seen, and the space between the nucleus and the outer shell is quite distinct.

The nucleus is evidently composed of urates, perhaps mixed with oxalates, while the crust is a secondary deposit of phosphates and carbonates with probably some urate of ammonia.

The history of this stone is here clearly written in this picture of its fragments.

The primary uric acid stone after reaching a size to cause irritation of the bladder and consequent changes in the urine became surrounded with a secondary stone deposit. This presently

split off and the uric acid nucleus then acquired another secondary envelope and this in turn is now beginning to separate.

## DISCUSSION

Dr. RAMON GUITERAS, of New York, said he had had one case of spontaneous fracture of vesical calculi, which he had presented before the Academy of Medicine in New York. In this case there had evidently been two, three, or four stones in the bladder. These had probably been crushed by the wall of the bladder, which was very thick, pressing them upon one another. There were removed in this case from 100 to 150 pieces through a perineal incision. Dr. Guiteras said he had not made the diagnosis of spontaneous fracture of stones in the bladder when he first started to operate. He had made the diagnosis of stones in the urethra. There were three calculi in the deep and posterior urethra. An instrument was passed down, but they could not be dislodged. He made a perineal section and extracted these pieces, and much to his surprise found the entire bladder filled with stones.

Dr. JAMES BELL, of Montreal, said he desired to mention in this connection a case that had interested him a number of years ago, of spontaneous fracture of stones in both kidneys. A stout, beer-drinking Englishman, thirty-five years of age, came into the hospital service in a very bad condition, with chills, high fever, scanty, purulent urine, and tenderness over the kidney regions. Renal calculus was suspected at the time, but his chief trouble was clearly an infection of some kind. The patient died in about forty-eight hours, without operation, and autopsy showed the pelves of both kindeys full of stone fragments. The stones were not analyzed. The finding of the fragments was a great surprise, as he had never heard of the condition before.

Dr. L. BOLTON BANGS, of New York, said that when the advertisement of the Buffalo lithia water first appeared, declaring that spontaneous fracture of stones in the bladder was possible, he, of course, ridiculed it; but subsequently, at an operation where he did a suprapublic cystotomy for the removal of stone, the appearances were such that he began to suspect that such a thing was possible. The majority of stones coming into our practice were those which might be termed secondary stones. But the appearances of this stone were such that is seemed to him the question of spontaneous fracture of stone in the bladder had not been given enough attention, and that such a thing was possible. As to the frequency of such a thing, he was glad to be enlightened, and it was a revelation that there could be so many of such cases.

Dr. HUGH H. YOUNG, of Baltimore, said this was an interesting topic, and one that had been very much neglected. His attention was called to it by a case he had several years ago. An old gentleman, who was suffering from enlarged prostate and had been to the Saratoga Springs and spent six weeks, had come to Dr. Young for operation. On cystoscopic examination spontaneously fractured calculi were seen in his bladder, numbering nineteen pieces in all. This was one of the most beautiful cystoscopic pictures he had ever seen, the fractured surfaces being clean cut, and showing the concentric lamellæ well. The fragments were evacuated through an evacuating apparatus, and most of them preserved. They agreed with Dr. Cabot's description, in that the nucleus removed did not participate in the fracture. In looking over the literature he was struck by an extensive series of articles by Ord of England, who came to the conclusion that the fracture was due to a change in the character of the urine which caused the albuminous nucleus to swell and burst its surrounding calcareous layers. Dr. Young said his case seemed to bear out that theory, the fracture having been produced by drinking in large amount a water that was new to him and that produced a marked change in his urine. He thought we had not paid nearly enough attention to the hydrotherapeutic treatment of cases of calculus before and after operation. It seemed to him that patients, upon whom nephrolithotomy had been performed, should, if possible, spend a few weeks each year for several years at some spa where a light, easily digestible water could be procured and drunk in large amount. Urotropin (hexamethalinamin) should be taken for protracted periods.

Dr. EDWARD L. KEYES, Jr., of New York, said he would like to question Dr. Cabot as to the practical bearing of this subject. The question was suggested to his mind by the remarks of Dr. Bangs concerning the Buffalo lithia water. Dr. Keyes said they had a collection at their office of over two hundred stones, and yet they had no record or evidence of any spontaneous fracture in the bladder, which would go to bear out Dr. Cabot's remarks as to the rarity of spontaneous fracture in this country. He had watched carefully for a record in which all the fragments of a stone spontaneously fractured were spontaneously passed, and he had never been able to see that it made any difference. They were not passed, and the condition of the patient remained the same. Therefore, water as a fracturer of stone was totally valueless.

Dr. CABOT said, in closing, that it did not seem to him that the therapeutic effect of Buffalo lithia water could be helped by these observations, since the stones could be removed so easily and thoroughly by mechanical means. It would be very rare, indeed, for a stone of any size to break into fragments

small enough to pass through the urethra. He did think that waters were of value in the after treatment, and to dissolve beginning stones, because he was perfectly sure that stones in the kidneys were dissolved; at least, he had had cases which made him feel convinced of that fact.

## THE APPLICATION OF PERINEAL PROSTATECTOMY TO CARCINOMA OF THE PROSTATE AND CHRONIC PROSTATITIS

By HUGH H. YOUNG, M. D., of Baltimore

A FEW years ago operations for the cure of prostatic hypertrophy were considered so dangerous that they were performed only as a matter of necessity. Now since the mortality has been reduced to nil and the operation of prostatectomy is performed everywhere there has been a tendency to extend the operative treatment to conditions other than that of simply hypertrophy. Among these may be mentioned cancer and chronic inflammation of the prostate. The evidence which has been accumulating during the past few years has shown that carcinoma of the protsate is a far more common disease than is generally supposed. In the past five years I have seen 250 cases of benign prostatic hypertrophy and 68 cases of carcinoma of the prostate. The proportion between cancer and hypertrophy was therefore over one to four. Of the 250 cases of hypertrophy, I have personally operated upon 230, and nearly all of the remaining 20 were operated upon by assistants. In only 5 cases did the disease prove malignant when a diagnosis of benign hypertrophy was made before operation. In the light of our recent statistics 4 of these cases should have been recognized on account of the stony hardness of the induration present. Most of these cases arrived when the disease was well advanced and a radical operation was out of the question, but at least 8 were early enough to be cured by a complete excision. In only two or three instances was there any evidence that the carcinoma had developed in a prostate which was previously hypertrophied. In nearly all instances the malignant disease begins in the non-hypertrophied

prostate and pursues its course with an entirely different pathology and symptomatology than hypertrophy. In most cases the disease remains within the capsule for a considerable period, and evidence is at hand to show that the capsule of the prostate forms an effective barrier for a good while. It is very rare to see carcinoma break through the posterior capsule and invade the rectum except very late in the disease. The progress of the growth, when it passes beyond the confines of the prostate, is generally upward along the ejaculatory ducts and around the lower portions of the seminal vesicles and vasa deferentia, where it forms a firm transverse plateau between the trigone and the fascia of Denovilliers which covers the prostate and seminal vesicles posteriorly.

Carcinoma of the prostate does not, except in rare instances, grow into the bladder around the urethral orifice and in only rare instances does it form a vesicle ulcer or tumor, and then nearly always in the region of the trigone.

The symptomatology is much more varied than in hypertrophy. Often the only symptoms are urinary and undistinguishable from those of hypertrophy, but as a rule pain is much more common. This may be located in the region of the prostate, the perineum, or the rectum, or it may be referred to other regions—in the back, buttocks, hips, thighs, groins, and testicles. Hematuria is not a very common symptom as shown by an exhaustive study of the history of 87 cases which I have had. The youngest patient in my series was 55 years of age and 50% of the patients were between 60 and 69 years of age. In 23 cases the symptoms had been present for two years; in 11 cases for three years, and in 8 cases for four years.

Examination showed in almost every case great induration, generally of the entire prostate and of stony hardness, the absence of intravesical lobulated outgrowths around the prostatic orifice and considerable increase in the suburethral portion of the prostate associated with stricture of the entire prostate urethra. Most cases arrived too late for radical measures, the disease already having involved the seminal vesicles and other pelvic structures. Some of these cases could void satisfactorily, and no treatment was advised. In others the catheter could be employed easily, and nothing else was suggested. In others, however, catheterization was so difficult and painful and the condition of the patient

so distressing that operative relief was necessary. In 6 cases suprapubic drainage was provided, the patient thereafter wearing a special apparatus which is devised to hold a large rectal tube in the suprapubic sinus. This tube is opened at intervals and the urine allowed to escape, and in some cases has been very satisfactory. In 7 cases the Bottini operation was performed, generally with very good immediate results. One patient was free from pain and discomfort at the end of four years. In most cases, however, there was a return of the obstruction at the end of a few months, and in some cases suprapubic drainage had to be provided In 10 cases the operation of conservative perineal prostatectomy was performed, care being taken to preserve the urethra and neck of bladder intact. With one exception the wound has healed as promptly and satisfactorily as in benign cases, and practically normal urination has been established. All of the patients have lived longer than one year with the exception of one who died shortly after the operation. Three have lived for two years and one is still alive four years after the operation. In only 2 cases has there been any recurrence of the obstruction to urination, and in 3 cases the result, two years after the operation, is still almost perfect. Ulceration of the posterior urethra has not occurred except in one case, and the subsequent course of the disease has shown that the mucous membrane has remained intact. After a comparison with the results obtained by other methods it seems now as if the proper treatment for cases of cancer of the prostate in which radical operation is out of the question is to remove the obstructing peri-urethral portions of the disease and thus to restore normal urination. The relief of all urinary symptoms makes the last days of the patient more comfortable than a difficult catheter life or suprapubic drainage.

An operation for radical cure has been carried out in 6 cases. A study of the pathology of autopsy cases showed conclusively that in order to effect a radical cure it would be necessary to remove the entire prostate with its capsule and urethra, the seminal vesicles and the adjacent portion of the trigone, and neck of bladder. Three of these patients are still alive. One died one year after the operation of intercurrent disease; one died seven weeks after the operation of nephritis; one died immediately after the operation of shock. Autopsy in this case showed ex-

tensive intraperitoneal metastases, although the bladder and upper portions of the seminal vesicles were free from disease, a remarkable pathological condition. This single operative death was, I believe, due to the unforeseen intraperitoneal involvement and cachexia. In other cases there has been no operative shock and if careful hemostasis is obtained there should be none. It is not a difficult procedure to anastomose the bladder with the membranous urethra, and there have been no persisting perineal fistulæ. Two patients are apparently cured now about two and one half years after the operation. A recent careful study of one of these cases failed to show any evidence of recurrence. An autopsy showed no remaining carcinoma in the case of the patient who died seven weeks after operation.

A review of these cases shows, I believe, that with early diagnosis a radical cure can be obtained. The fact that the disease is so well encapsulated and slow in its growth gives hope for a large percentage of cures if the operation is performed early. If we can persuade physicians to make routine examination of the prostate, to suspect the prostate in cases of vague pains of any sort below the diaphragm, and to insist on an exploratory operation when marked induration is present in men past 45 years of age with the idea of carrying out a radical operation if the disease is malignant, I believe many radical cures can be obtained.

*Chronic Prostatitis.*—Chronic prostatitis is usually curable by simple local treatment, principally prostatic massage, but in a small proportion of cases the conditions present warrant, I believe, surgical intervention. These are of two kinds: Those in which definite obstruction to urination is present with symptoms similar to those of prostatic hypertrophy; and cases where very extensive chronic inflammatory changes too marked or too painful to be cured by prostatic massage are present. Obstructive symptoms, have been present in about 10% of my cases of prostatitis. In 42 cases local treatment was tried in 20; the Bottini in 5; perineal prostatectomy in 13. Four cases were not treated. The 4 cases on whom the Bottini operation was performed had fairly satisfactory results. Two cases were followed by epididymitis and incontinence persisted for several months. In 1 case the obstruction recurred and a perineal prostatectomy was performed later. The 13 patients on whom perineal prostatectomy was

performed were of the following ages: Two, 32; two, 37; two about 45, and seven over 50 years of age. The youngest patient had led a catheter life two years, another 37 years of age for twelve years, and in both of these cases the retention of urine was just as complete as in prostatic hypertrophy, though only a small inflammatory median bar was present. In the other cases there was only a moderate amount of residual urine present, but the obstruction was marked, the difficulty in urination considerable, and the irritability great. In all these cases the bladder was hypertrophied and contracted, often markedly and evidently a result of the increased work necessary to void urine through the strictured orifice. There was no stricture of the urethra present in any of these cases. The operation was performed in a way very similar to that for hypertrophy. The urethra and ejaculatory ducts were very carefully avoided, but the inflammatory median bar war removed through one of the lateral cavities after removal of the lateral lobes. More prostatic tissue was left around the ejaculatory ducts than in cases of prostatic hypertrophy, and the impairment of sexual power after the operation has only been transient, and 2 patients report that there has been a marked improvement in this respect since the operation. In removing the fibrous median bar I found it advisable to make use of a sharp tenaculum with which the median bar is drawn into the lateral cavity, where it is enucleated and partially excised. The same operation was performed in 4 cases of severe chronic prostatitis in which there were no symptoms of obstruction. In these cases the median portion of the prostate was not disturbed. Three of these cases had been subjected to local treatment for a prolonged period without benefit, but the results obtained by operation were rapid and excellent. One of these cases has since married and has become a father; others report no sexual disturbance. I therefore feel justified, after a study of these 17 cases of chronic prostatitis, in which the operation of conservative perineal prostatectomy was performed, in saying that operative treatment is indicated in a certain small but very definite number of cases. Those with marked obstruction to urination cannot well be relieved by anything but operative intervention, and those cases with severe inflammatory changes, infiltration fibrosis, etc., which do not respond to local treatment or may be associated with such painful

symptoms as to prevent the administration of prostatic massage can be safely and quickly cured by partial excision as afforded by the operation which I have proposed. I believe that in the future we will come more and more to a conservative operative treatment for chronic prostatitis, many cases of which can otherwise be cured only after long months or even years of local treatment. The operation is naturally delicate and requires experience.

As to the results which I have now had with conservative perineal prostatectomy in cases of prostatic hypertrophy, I may say that in 259 cases there have been but 7 deaths, a mortality of 2.7%, and that in the last 132 consecutive cases there has not been a single death, and all but 5 of these patients (who were recently operated upon) have left the hospital. There has not been a death for about two years, and among the seven fatalities mentioned above the earliest occurred eight days after the operation. These seven patients were in very bad condition. Most of them suffered from renal disease. One patient was 87, one 81, and most of the others over 70 years of age.

The functional results have been excellent, and in only 7 cases was there more than 50 cc. residual urine present on the discharge of the patient from the hospital. Incontinence of urine has generally disappeared very soon after the operation, and in 16 cases interval urination was established between the third and eighth day. In only 2 cases has definite incontinence of urine, persisting for a prolonged period after the operation, been met with, and both of these cases now show definite evidence of tabes. A few cases in which urination is urgent and the sphincter unable to retain urine long when a strong desire to void comes on are present. As the operation is performed between the two sphincters no case of incontinence should occur if the operator is careful to preserve those muscular structures. Contracture of the bladder has, in a few cases, caused a persistence of frequent urination, but most of these cases that have submitted to subsequent treatment have been entirely relieved by frequent dilatation of the bladder by hydraulic pressure. Many of the so-called imperfect results are, I believe, due to cystitis and vesical contracture, and all I believe can be relieved by appropriate post-operative treatment. All but 4 cases have been cured of the obstruction to uri-

nation and in these, I believe, I was at fault in not removing all of the median portion of the prostate.

Recto-urethral fistulæ are present in 2 cases, but in the last 150 cases in which the levator muscles have been carefully approximated by a single suture of catgut in front of the rectum there has not been a single case of breakdown or recto-urethral fistula.

In conclusion I may say that it has been distinctly shown that prostatectomy is a very benign procedure, and that it can be undertaken in individuals of great age and bad condition. That it is by far the safest treatment for hypertrophy; that the perineal route is alone satisfactory for every character of enlargement, the small fibrous non-enucleable type as well as the great soft adenomatous intravesical hypertrophies; that it is also suitable for carcinoma of the prostate and is probably the best procedure to adopt in cases where a radical operation is out of the question, as it generally leads to a good functional result and freedom from dysuria for a long period, often as long as the patient lives; that chronic prostatitis occasionally leads to the formation of a definite obstructing bar in the median portion of the prostate (even in young men), resulting in retention of urine, which may sometimes be complete and require a catheter life, and for these conservative perineal prostatectomy is entirely successful in obtaining a permanent cure. In cases of very severe chronic prostatitis with marked infiltration, or with severe painful symptoms, which render local treatment impossible or unsatisfactory, a partial excision of the lateral lobes through the perineum generally leads to a rapid and complete relief of the symptoms and an ultimate cure of the condition which can hardly be effected in any other way.

## DISCUSSION

Dr. WILLIAM T. BELFIELD, of Chicago, said the surgery of the cancerous prostate practically began with Dr. Young. We had all known for many years that cancer occurred in the prostate, and it had been dawning on us for the last ten or fifteen years that it was not the rare thing we used to suppose. He thought the frequency of prostatic carcinoma had been fairly well recognized in the last ten years or so, but the surgery of it had been a thing

that everybody, so far as he had seen, liked to dodge. Now, it was evident that Dr. Young got better results than anybody else had recorded, in the literature, and it certainly gave us courage to attack these cases that we used to be very willing to treat symptomatically. There was, however, one fact which had always struck him in connection with carcinoma of the prostate, which seemed to have been lacking in Dr. Young's cases, and that was the early and extensive metastases. He had in mind now a case of carcinoma of the prostate, with a large mass in the sternum as big as his fist, which was, as section showed, metastatic carcinoma. And so in a great many cases we found that metastases were early and frequently disastrous. In one case he made a diagnosis of cancer, and while waiting for operation the patient suddenly developed a paraplegia, evidently due to a metastasis in the vertebræ, which autopsy showed that to be the fact. So that, he ventured to assert that we would find there a drawback in operating, even with the excellent technique which Dr. Young had portrayed,—a drawback which affected the ultimate results, which, of course, were what we were after; because cancer of the prostate often gave the patient very little pain or urinary distress. So that the value of the method would depend, after all, on the ultimate results, and those would be determined largely by the metastases. So far as operating in chronic prostatitis was concerned, he had yet to be convinced that it was at all necessary. He had, as others had done, repeatedly made a simple perineal incision and stretched the prostate, especially the neck of the bladder, in these young men with chronic prostatitis; and he had never wished yet that he had done anything more. He thought that answered the purpose. Perhaps he had not met the cases that required excision of parts of the prostate but it did not strike him that this was an operation that would ever become widely necessary.

Dr. L. Bolton Bangs, of New York, said this question of carcinoma of the prostate, especially in relation to the surgical diagnosis, had interested him very much, and he confessed that he was still in somewhat of a chaotic condition as to what positive data he should base an early diagnosis upon. Some years ago, as a teacher of prostatic surgery, he had found that his experience controverted the teaching of the text-books that there were very few cases of primary carcinoma of the prostate. He found that there were cases that he felt certain were primary neoplasms in the prostate, and he ventured to make a communication upon this subject, which, he thought, had brought forth fruit. He confessed yet, notwithstanding all that Dr. Young had said, that in some cases an early diagnosis of carcinoma of the prostate was absolutely impossible. Even in the clear manner demonstrated to us, it would

still be observed that much depended on the refinement of touch and the determination of relative firmness or hardness, and that, he thought, would depend very much on the temperament of the individual making the examination, to say nothing of his experience. And it was a very important matter, because his experience agreed with Dr. Young's, that the initial sympton was not necessarily hemorrhage. That, is would be remembered, had always been regarded as a very important symptom of primary carcinoma of the prostate. He had not found it to be so. He had been made suspicious by this very question of the feeling of the prostate, together with the picture presented, and these had been confirmed by subsequent events. But, as we all knew, after we came to a point where we felt warranted in advising an operative procedure, it was too late. As Dr. Belfield had so well said, metastases had taken place, and we found ourselves asking the question whether it was really worth while to operate in these cases. He had operated on patients in order to give them a chance, and he had had the misfortune to see them gradually slip away from him. Therefore, he would welcome anything that would enable him to make an early diagnosis.

Dr. ARTHUR T. CABOT, of Boston, said that with the technique which Dr. Young had previously shown us, making a radical operation seem more possible in these cases, it became of the greatest importance to recognize our cases early. His own experience in cases of prostatic cancer led him to think nodularity more common than Dr. Young had described. He should certainly note the presence or absence of that condition more closely in the future. He had found that tightness of the prostatic urethra was characteristic, and he had several times met a symptom which he had seen mentioned, namely, pain on withdrawing the catheter. He had found this in several cases to a marked degree—a peculiarly severe pain on withdrawing the catheter. Hemorrhage had not been an early symptom. In the later stages of the disease hemorrhage on the introduction of instruments was a very noticeable feature. He had operated only two or three times in cancerous prostate, and in all of these he had done what would be considered a partial operation. He had supposed the cases were ordinary hypertrophy until the pathological examination was made. He agreed with Dr. Young that carcinoma of the prostate remained a local disease longer than many other forms of carcinoma. While we occasionally see the early metastases such as Dr. Belfield described, he thought that in the greater number of cases there were no evidences of these metastases. He had had one case of carcinoma which had existed five years without an operation, and then there was no evidence of anything more than a local carcinoma. The case that he alluded to came to him at the end of

the five years, and he was able to quite clearly establish the fact that the condition had existed for that time. As to chronic prostatitis, he had operated upon but two cases. Both of them, he thought, were cases of vesiculitis combined with prostatitis. Both of them were in rather young men, and both of them were in men who were suffering horribly. He had been very much interested in hearing Dr. Belfield's contribution, and would certainly try to carry out his plan in some of these cases before proceeding with a more severe operation. The patients mentioned had for many years been passing water oftener than once an hour, often two or three times an hour. Urination was painful, they were very great sufferers, and greatly reduced in strength and flesh. One of them was very considerably improved by the operation. The other one, unfortunately, died. He was reduced almost to a shadow, and was not able to survive the operation. Dr. Cabot thought that in these case where the prostate was extensively disorganized by suppuration, treatment through the vas or treatment of the ampullæ would hardly fill the indications, and in these cases we must still occasionally resort to prostatectomy.

Dr. CHARLES L. GIBSON, of New York, said he was glad to be able to contribute to the efficiency of Dr. Young's technique. He had done this operation, and as Dr. Young had said, it was not so formidable as would appear from the photographs. The only difficulty was the separation from the rectum. That must be done by dissection with the scalpel. Once we were clear of the rectum, we had thorough control of the situation. We could use a clamp or a tractor to pull the tumor down, and enucleate it, cutting it away from the bladder. The plastic part of the operation was an easy matter. Both of his patients died, one fairly soon after the operation. As to chronic prostatitis, he said he had not had occasion to view it from this standpoint, but he had been quite successful in one or two cases in treating them by Dr. Alexander's method, *i. e.*, doing an external urethrotomy and making the lobes of the prostate communicate with the urethrotomy opening—*i. e.*, the same treatment one would adopt in a case of prostatic abscess. The openings were packed and allowed to heal by granulation. In one case recently where the man was unwilling to have the urethra opened, the lobe was incised without opening the urethra. The patient was entirely restored to health and usefulness, and relieved from his pain, etc.

Dr. LOUIS E. SCHMIDT, of Chicago, said he wished to report three cases of operative interference in prostatitis. Dr. Belfield would probably recall that two of the cases had been demonstrated two years ago. All three cases were operated on for symptoms such as Dr. Young had mentioned, but, in addition, the predominant symptom was pain. He had watched these cases a year or

two following the operation, and he could only state that in those cases, a year later, the pain was exactly the same as at the time of the operation. In other words, no improvement had resulted as to that one particular symptom. However, the frequency of urination was somewhat improved. In doing the operation Dr. Schmidt said he did not enter the urethra. He simply passed a sound into the bladder, made traction on the prostate in that way, and took out wedge-shaped pieces. In two of the cases, one piece was taken out on each side. The wounds were drained for one or two weeks. These three cases had received all the usual treatment for prostatitis—including dilatation of the internal urethral orifice for twelve to eighteen months previous to operation.

Dr. H. M. CHRISTIAN, of Philadelphia, said this question of the diagnosis of carcinoma of the prostate as differentiated from hypertrophy of the prostate seemed to him a most important one as regards prognosis, and he was very glad to hear Dr. Young bring out the question of the stony hardness of the prostate. To his mind that was a most important point. He also agreed with Dr. Cabot that in the majority of the cases there was some nodularity of the prostate. He had had three cases during the past year in which he did a suprapubic prostatectomy, with the idea that they were cases of ordinary hypertrophy. They presented this stony hardness, and on opening the bladder it was simply an impossibility to enucleate the prostate or to remove any portion of it except with the rongeur forceps. These prostates were later shown to be carcinomatous. Another point that he wished to call attention to was sciatic pain. He mentioned a case that had been originally operated on by Dr. Martin for a hypertrophied prostate, by a perineal operation, and who later died under his care of carcinoma of the prostate. In that case sciatica was one of the chief symptoms that the patient complained of. The diagrams that Dr. Young had shown were very interesting, and to his mind very convincing. He mentioned particularly the three diagrams showing the enlarged prostate, the chronic prostatitis, and the carcinomatous prostate, and the fact brought out by Dr. Young as to the cystoscopic examination and the point of being unable in his cases to palpate the cystoscope in carcinoma, and the ability to palpate it in enlarged prostate, he thought a most convincing and important fact. He was inclined to agree with Dr. Belfield that we had hardly reached the point where we were prepared to operate in chronic prostatitis in young adult life. He thought, after all, that the operation according to Dr. Young's method was an operation, and that Dr. Belfield's method of treatment would answer the purpose in the majority of cases. He thought that in many of these cases there was a contraction of the vesical neck, in which a simple urethrotomy would answer perfectly well.

Dr. EDWARD MARTIN, of Philadelphia, said he had not heard mentioned in the discussion of chronic prostatitis the associated spasm of the vesical sphincter, which could be relieved by over-dilatation. The over-stretching tore the connections of the ganglia that caused the contraction, and relieved that contraction. Dilatation of the internal vesical sphincter with a 44 instrument did not affect the condition. In these cases the index finger could be easily introduced. Dr. Martin said he had had an instrument constructed which would dilate up to 90 French, which had given much comfort and joy to the patients suffering from this form of vesical contraction. Dr. Martin said that in prostatic carcinoma bone metastases might occur before any evidence of prostatic trouble. He had had one patient who showed evidences of root pressure. The prostate was examined, but no signs of prostatic trouble were found. Two months later he developed a wooden feel to the prostate, and finally died of prostatic carcinoma. In another case the clinical evidence of cancer was there, but microscopical examination of the prostate showed it to be fibroid induration. The patient lived comfortably for six months, but seventeen months afterwards died of cancer.

Dr. JOHN VAN DER POEL, of New York, had recently seen two cases, which were interesting as regards the absence of metastases, as far as could be made out. The first one he had diagnosed as a case of sarcoma. The prostate was very large, and had an almost wooden or bony hardness. On account of its regularity and smoothness of surface he took it to be a case of sarcoma. There were no indications of metastasis. The bladder wall was not at all involved. Cystoscopic examination simply showed that the middle and lateral lobes were pressed inward into the bladder cavity. The other case was one which he had diagnosed as carcinoma, on account of the irregularity of the prostate and its wooden consistence. Here also was he unable to make out any metastases. Unfortunately, neither case would permit of an operation, and they were lost sight of. As to chronic prostatitis, he said, personally he should be rather loth to operate. He had not had the success that Dr. Young had had in preserving the sexual functions of the individual after operations for hypertrophy of the prostate. In fact, in not a single case in which he had operated—eight in all—had he been able to preserve the sexual function. They all lost their sexual functions afterwards, both as to desire and ability, although two of them were quite beyond the age when that function would be an important factor.

Dr. EDWARD L. KEYES, Jr., of New York, said, concerning the operation for chronic prostatitis, that he and his father and Dr. Chetwood had been operating on these so-called cases of contracture of the neck of the bladder

for a long time, which were apparently related to some of the cases which Dr. Young had reported. They had had very good results in these cases by burning them down by Chetwood's modification of the Bottini operation. The points he wished to emphasize at the present were that it would be well to consider the possible advantage of the instrument suggested by Dr. Martin, and that it was necessary in all cases of chronic prostatitis associated with pain, in young persons, to examine carefully and repeatedly for residual urine. If residual urine was found that was the best evidence that some stretching or cutting of the neck of the bladder must be done. He had to confess that Dr. Young's operation for the removal of the prostate for these cases did not appeal to him, as it struck him as going roundabout instead of directly at the point at issue. He asked Dr. Young whether he considered that prostatic hypertrophy did really begin to show itself clinically in young persons. He recognized that we did not know what prostatic hypertrophy was, but Dr. Young had reported three cases in young men, all of which pathologically showed only chronic prostatitis and no actual hypertrophy.

Dr. HARVEY G. MUDD, of St. Louis, said he might mention one case bearing on the point brought up as to the extreme hardness of the cancerous prostate. The patient was an old doctor, past 80 years of age, who presented a very large, smooth, soft prostate. On starting to do a perineal prostatectomy, the capsule was broken through, and it was found that they were dealing with a large soft cancer of the prostate.

Dr. YOUNG said in closing that he wished to thank the members for their very full and free discussion of this subject. In regard to the operative treatment of chronic prostatitis, he wanted, first of all, that it be understood that he did not suggest that as a routine treatment. He had only operated on 4 cases of chronic prostatitis without obstruction, out of about 1,000 cases, so it would be seen that he was not a very great advocate of the operative treatment. He mentioned 2 cases. One was given the ordinary treatment, massage, irrigations, dilatations, instillations, etc., but grew steadily worse. Treatment was then stopped for two or three months, but the patient continued to suffer from very great pain, dysuria, marked sexual symptons, grave neurasthenia, etc. The prostate was very markedly inflamed. He thought the pain was probably due to pressure by the lateral lobes on the nerves of the prostatic plexus. In this case a very conservative operation was performed. A complete removal was not done, as the patient had no obstruction and no hypertrophy. The "ejaculatory bridge" left was much wider, and more tissue was left around the urethra. The patient was entirely relieved, and his sexual powers returned. He was seen a year after operation, and he was then

in excellent condition and spermatozoa were found in the secretion obtained by massage. Another man had marked prostatitis, with irregular, very indurated lobes, a condition that would have taken a year or two to cure by massage, etc. He also had a persistent gleet. He could remain only a month, and it was decided to operate on him. The median portion of the prostate was not disturbed. The patient was soon entirely well, leaving the hospital in a month. Several months later he was married and is now a father. The other cases were those in which the obstructive symptoms were by far the most important. In 5 of these a Bottini operation was done, but the persistence of a marked prostatitis after the operation and the imperfect relief of obstruction had led him to perform a very conservative perineal prostatectomy for these severe cases of chronic prostatitis with obstruction. He did not believe in going too close to the urethra and preserved the posterior commissure containing the nerves supplying the verumontanum. It was important to remove the outer portion of the lateral lobes and that little group of hypertrophied prespermatic glands that caused the obstructive median bar. Some of these cases were associated with a sclerosis of the sphincter, and he generally dilated the sphincter. The results obtained now in 13 cases have been most satisfactory. In regard to the carcinoma operation, he was firmly convinced from specimens that it was absolutely essential to remove a portion of the trigone and the seminal vesicles with the prostate, if we were going to have a radical cure. He was more and more convinced as time went on that glandular metastasis was rare and late in carcinoma of the prostate. Kaufmann had found in 100 autopsy cases only 27 with glandular metastases. Bony metastases were probably more common, but also late in appearing. In exposing the rectum in prostatectomy and in order to facilitate the operation, he used a special angular posterior retractor (which was shown), which had afforded a much better exposure of the prostate.

# REPORT OF A CASE OF FIBRO-ADENOMA IN THE BLADDER WALL, OCCURRING IN FUNDUS OF BLADDER

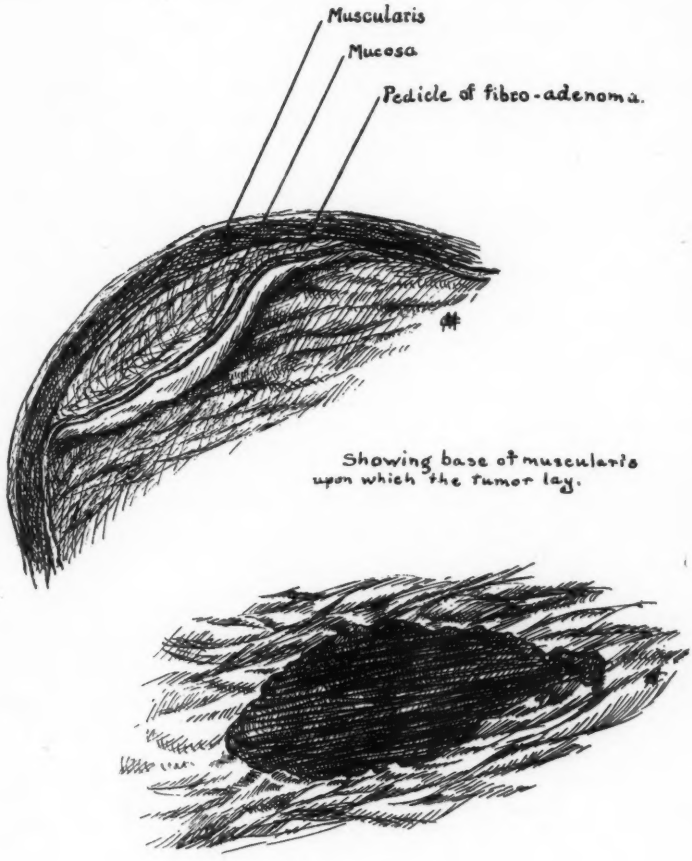
By FRANCIS R. HAGNER, M. D., of Washington

L. R. Aged 68. The patient has been suffering from prostatic obstruction, gradually increasing in severity for the last five years. He had practically completed obstruction, passing only a small amount of urine at frequent intervals, residual urine one quart.

Examination per rectum showed a moderate size, firm prostate.

On cystoscopic examination several small diverticula were noted and in one of these diverticula, well back in the left lateral wall a small stone was seen. A perineal prostatectomy was performed and futile efforts were made to remove the stone by this avenue, as it was found impossible to grasp it with forceps, on account of its location. A suprapubic cystotomy was performed and the stone removed. On examining the anterior wall of the bladder with the finger a tumor was felt to the right of the median line with a pedicle extending to the fundus of the bladder; this tumor was apparently attached to the muscularis, being covered by the bladder mucosa as shown in this drawing.

The tumor was not discovered during the cystoscopic examination, as it was under the mucous membrane and only appeared as a smooth ridge in the largely dilated bladder. Sections from the tumor showed it to be a fibro-adenoma, with degenerated and inflammatory processes, and in places the basement membrane was lacking and the epithelial cells appeared to be infiltrating the connective tissue, showing a probable beginning carcinoma. Possibly the most rational explanation of the origin of the tumor judging from the location is that it came from the urachus. The patient made an uneventful recovery and has an excellent result, being at present in good health.


Muscularis
Mucosa
Pedicle of fibro-adenoma.
Showing base of muscularis upon which the tumor lay.

# SURGERY OF TUMORS OF THE BLADDER FROM A MODERN ASPECT

By L. E. SCHMIDT, M. D., of Chicago

OPERATIVE interference in tumors of the bladder is not at the present time conducted in a uniform manner, nor is it based on any generally accepted rules, as is the case in other domains of surgery. Each operator has notions and fancies of his own and operates accordingly, employing in many instances methods which, if applied in other branches of surgery, would bring ridicule on his head. Therefore, the possibility of approaching this subject in a more orderly and systematic manner, as well as the great scientific advantage to be derived therefrom, has induced us to attempt, by taking into consideration the work that we had observed in various genito-urinary clinics, by availing ourselves of the pertinent literature, and by analyzing our own experiences, to establish certain basic principles on which, as a foundation, might eventually be built up a rational and consistent surgery of tumors of the bladder.

From the very first one essential principle becomes apparent: benign tumors should be approached from the inside, malignant tumors from the outside of the bladder. The intrinsic qualities of a benign tumor are such that it is manifestly sufficient if its mucosa, submucosa and pedicle alone be removed; it is not necessary in operating on such a tumor to go through the entire thickness of the bladder wall and resect all its layers.

## CYSTOSCOPE OR INCISION?

In approaching benign tumors from the inside of the bladder we have at our command two methods: one, the endovesical, through an operative cystoscope; the other through an incision in the viscus, which renders accessible the implantation of the growth. In the endovesical method, after proper dilatation of the bladder, the operative cystoscope is introduced, the tumor is focused and the galvanocaustic snare is developed into a loop within the bladder. Then, in case the tumor is not too large, the

PLATE VIII.—Presented by Dr. L. E. Schmidt.

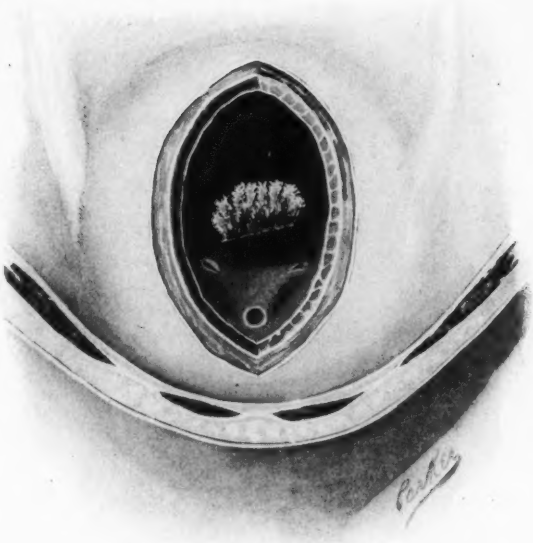


FIG. 1.—Benign tumor exposed.

loop is passed over the growth and down to its base and constricted until it fits snugly around the pedicle. The electric current is now turned on and the interpolated resistance is diminished until little bubbles appear around the loop, after which the pedicle is seared through by slowly constricting the loop. Then, if deemed necessary, the galvanocaustic loop-carrier is withdrawn and a straight, solid galvanocautery is inserted in its place, by means of which the stump of the pedicle is again cauterized.

The severed tumor either is picked up by forceps introduced through the cystoscope or, after removal of the cystoscope, is pumped out through an evacuator; if very small it may be left to be expelled by the urinary stream. The suggestion of using a steel wire snare, instead of the incandescent platino-iridium loop, to crush the tumor and thus prevent subsequent hemorrhage (B. Klose) seems to have been based largely on theoretical speculation, for actual experience has not justified its claims. In case the tumor is rather large it may be removed piecemeal by means of the galvanocaustic snare; when the pedicle is reached it is seared through by means of the loop or burned down with the solid galvanocautery.

Although the instruments almost exclusively used by the operators who are doing endovesical work are those with indirect view, we desire to state that, in our opinion, which is based on manikin practice and experience on the living subject, it is of decided advantage to use the cystoscope of direct view in operations of this character. As a matter of fact, the cautery of Nitze's operative cystoscope almost entirely obstructs the view of the point of its application; this defect has led to the suggestion of using a fenestrated galvanocautery (B. Klose). With the instrument of direct view it is much easier to pass the wire loop over the tumor and down to the insertion of the pedicle, first, because the loop and the tumor are in the direct line of view, and, second, because of the short distance between the window, the loop-carrier and the growth. The same reasoning holds good in the use of the solid galvanocautery. It must be admitted, however, that in operating endovesically on a tumor located in the vertex of the bladder the cystoscope of direct view can hardly be used; in such cases, which, however, are extremely rare, the so-called long wire-loop of Nitze's operative cystoscope should be employed. Judging from our

experience on the manikin, it would seem as though many of the disadvantages observed in the operative cystoscope of Nitze might be avoided by using an instrument of indirect view, constructed after the pattern devised by Casper.

There are some writers who object on principle to all endovesical operations so far as tumors of the bladder are concerned, basing their objections on the possibility of subsequent hemorrhage, the less extensive excision of the base of the tumor, and their belief that, since such an interference calls for specialized study and skill, it will never become a routine surgical procedure (Cathelin). Technical objections coming thus from men who have had no personal experience with the endovesical methods have no weight. The theoretical objections as to the insufficient extensiveness of the operation are refuted by the statistics of those who are actually doing endovesical work (Nitze, Weinrich, Klose, Casper, Keersmæcker). Among these Nitze stands pre-eminent; there are no statistics which compare even approximately with the splendid results obtained by this master and his pupils. In the light of such work even those who are most pessimistic as to the outcome of operations on bladder tumors, however radical the excision may be, are beginning to realize more and more the necessity of employing the endovesical procedure (Keydel).

### EXSECTION

The other method for the removal of the benign tumor involves its bloody exsection after the bladder has been opened by an incision. The only route through which such an operation should be approached is the suprapubic, for in this way free access is obtained to all parts of the bladder. We desire to submit, as the fundamental principle of this operation, that it be conducted with one object always in view, *i. e.*, the complete closure of the bladder after the tumor is extirpated. In order, however, that primary union and uneventful recovery ensue, it is of paramount importance to bear certain details carefully in mind, remembering always that a liberal incision through the anterior wall of the bladder is requisite for smooth, clean surgical work inside the viscus; nowhere is button-hole surgery more out of place than in bladder work.

PLATE IX.—Presented by Dr L. E. Schmidt.



FIG. 2.—Preliminary sutures run underneath the base of the benign tumor.

FIG. 3.—Suture line after removal of the tumor.

PLATE X.—Presented by Dr. L. E. Schmidt.

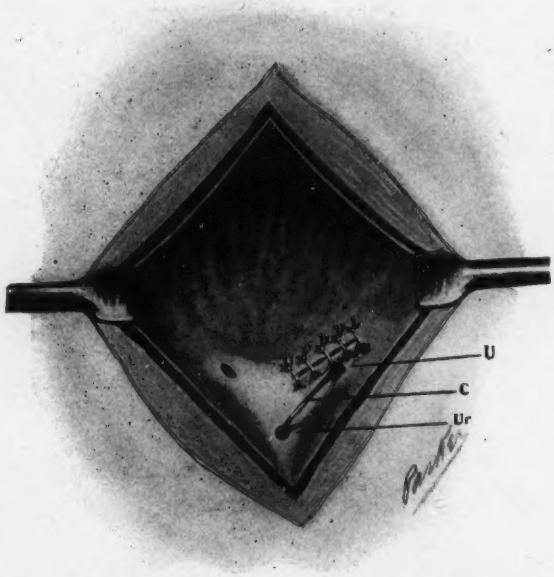



FIG. 5.—Suture line after removal of the tumor with catheter in place. Ur, urethra; C, catheter; U, ureteral mouth.

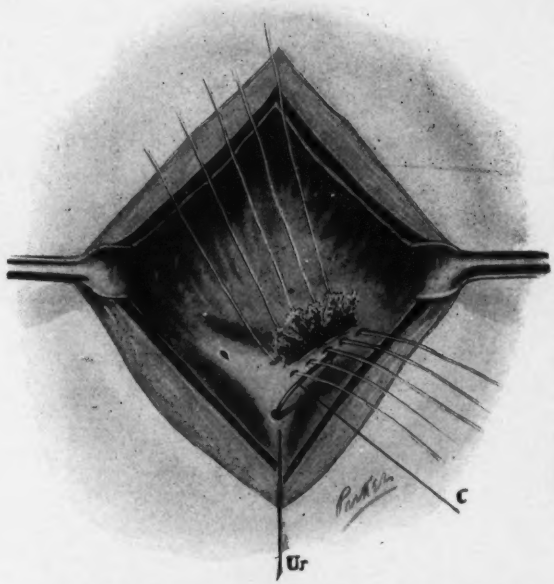



FIG. 4.—Ureteral catheter inserted into both ureter and urethra to prevent tying up of the ureter by the preliminary sutures. Ur. ureteral orifice: C, catheter.

The anterior aspect of the bladder should, therefore, be freely exposed in order to gain space for the generous incision; perivesical fat and the peritoneal duplication are to be stripped off until a sufficiently large area of the bladder wall is exposed. The bladder wall is caught by a few sutures, which are used later on as guy ropes. The bladder is incised between these sutures and all squirting blood vessels are ligated. The tumor and its base are now brought into full view and made easily accessible either by catching the base of the bladder with sutures and pulling on them so that the field of operation is brought into the incision and close to the surface, or by having an assistant insert two fingers into the rectum or into the vagina, as the case may be, and thus force the base and the fundus of the bladder upward (Fig. 1). Sutures are now run beneath the insertion of the tumor and are promptly tied one by one in the path of the operator as he is excising the base of the growth (Figs. 2 and 3).

This detail in technic prevents the hemorrhage which otherwise would flood the field of operation and necessitate extensive sponging and continual hunting for the excision wound, and thus avoids a traumatism of the mucosa which might interfere with the prompt and complete closing of the bladder. Care should be taken not to grasp the tumor with the fingers or the forceps, since, as a rule, such growths are very friable and are apt to bleed profusely when crushed or torn. If the tumor be located close to the vesical portion of one of the ureters one end of the ureteral catheter is run a few inches up into the ureter, previous to the insertion of the preventive stitches, and the other end is led through the internal orifice of the urethra and thence outside by way of the urethra. Should some of the preventive sutures encircle the vesical end of the ureter the fact would become apparent on attempting to remove the ureteral catheter; it would be engaged. In this case the catheter is simply left in place for a week or so, until the healing process has progressed sufficiently, and then withdrawn (Figs. 4 and 5).

After the main tumor has been removed it is very important to inspect the entire inner surface of the bladder in order to discover smaller-sized papillomata, should such be present. Particular attention should be paid to the parts opposite the main tumor, since we often find these smaller growths in those areas

which come in contact with it when the bladder is empty. This condition is of such frequent occurrence that the suggestion of contact infection forces itself on the mind. All such smaller tumors, if present, should be removed in the manner described above; the erroneous diagnosis of a relapse of the removed tumor is often due to the fact that these have been overlooked and not extirpated. After the viscus has been cleared of all growths, large and small, and after the excision line or lines have been closed by sutures, the incision of the bladder is closed by means of two layers of sutures. The essential feature of this suturing is to bring together only denuded and bleeding surfaces and to prevent any impaction of the mucosa into the suture line.

The closed viscus is now so suspended to the abdominal wall as to exclude any dead spaces and thus prevent the accumulation of secretion; it is important, however, in order to prevent pressure necrosis, that the suspension sutures do not interfere with the suture line closing the vesical incision (Fig. 6). The abdomen is closed in the usual manner. As a rule patients urinate naturally a few hours after the operation; it is only when a patient does not do so that catheterism at proper intervals is resorted to. The permanent catheter should never be used, as it offers no advantage; on the contrary, it always leads to irritation, quite often to infection.

### TRANSFORMING BENIGN INTO MALIGNANT GROWTHS

It is often contended that the simple removal of benign tumors, such as is indicated above, leads in the majority of cases to recurrence, and that all recurrences are of a malignant character; on the other hand, there are opinions which differ entirely from this contention, some coming from authoritative sources (Lubarsch, Birch-Hirschfeld). A kind of middle ground is taken by Wendel:

"We are compelled to believe that not infrequently bladder tumors will appear which are, in outward appearance and in histologic and clinical characteristics, unquestionably benign, but which later on might become transformed into cancer. In all such cases there is a stage in which surgical interference may occur early enough to remove these tumors with the same favorable outlook as is the case in other benign tumors."

PLATE XI—Presented by Dr. L. E. Schmidt.

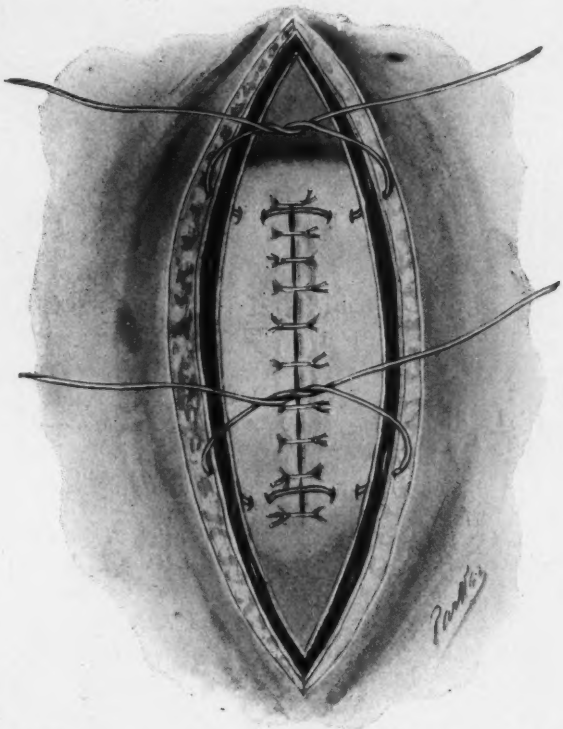


FIG. 6.—The closed bladder suspended to the abdominal wall by two sutures.

PLATE XII.—Presented by Dr. L. E. Schmidt.

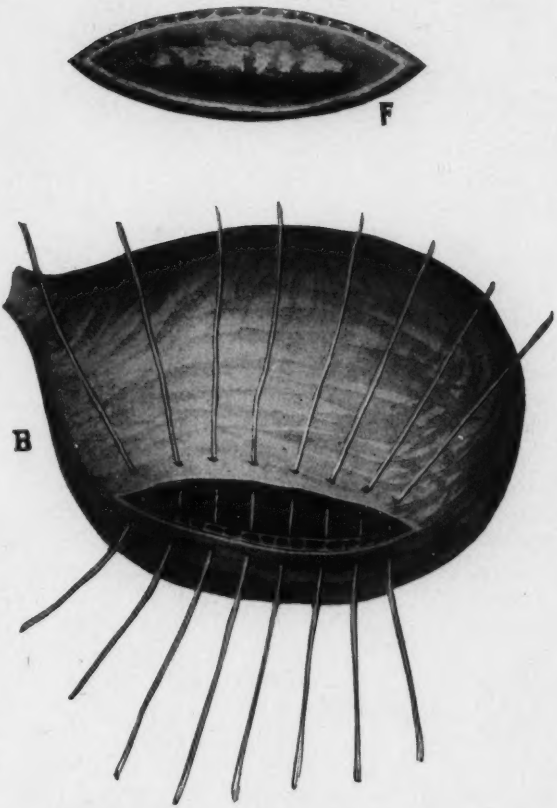



FIG. 7.—Excision of section of bladder wall carrying a malignant tumor. B, bladder; F, section.

As a matter of fact, most authors have relinquished the idea that benign tumors suffer relapse of malignant character (Rafon.) All men of actual experience concur in the opinion that benign tumors should be operated on immediately after their discovery (Rafin, Malesherbes, Hegue, Escat, Desmos, Carlier, Hamonic, Nitze, Fischer, Casper, Fedoroff, Bary, Fedenat, Albarran, and others).

Operations for the removal of malignant tumors should be guided by principles derived from sound surgical reasoning and not by traditional superstition. We believe that all operations of this character should be started from above, but at the same time we wish to say emphatically that the traditional method of making a suprapubic incision into the bladder and of then hunting for the malignant tumor from the inside should be absolutely condemned. If a surgeon were dealing with a pyloric carcinoma, would he first make an incision through one of the curvatures and endeavor, by working his way through this opening, to dig the cancer out from the inside of the stomach? Certainly not! Why should not the same reasoning hold good in operations for malignant tumors of the bladder? The incision into and through the bladder wall should be made as close to the location of the tumor as is consistent with the obvious demand that the lines of excision should run through apparently healthy tissue (Fig. 7). Making a routine median incision into the bladder regardless of the location of the tumor means inflicting an unnecessary injury on the bladder. The recognition of these facts calls for a topographic diagnosis of the tumor before operation and demands a free exposure of that portion of the bladder which is going to be in the field of resection. Sometimes the base of the tumor can be definitely outlined, or the presence and extent of infiltrations ascertained only by palpation after the bladder is made accessible by detachment and incision.

The steps of the operation should be as follows: The suprapubic incision is made; the perivesical fat, which is thus exposed to view, together with the peritoneum, is stripped from the bladder to such an extent that the anterior aspect of the viscus is freely exposed. A few sutures are now drawn through this part of the bladder to serve as guy ropes in facilitating its further manipulation. The denuding of the bladder and its detachment from the

adjacent tissue is continued until its exterior surface, in so far as it corresponds with the seat of the tumor inside, is exposed, thus giving additional leeway for resection through healthy tissue. The flap formed by the perivesical fat is now tilted back over the peritoneum and fastened there with a few stitches; in this way a firm protection is furnished for the peroitneum against subsequent infection.

The bladder is now dragged to one side by means of the guy ropes and an incision is made into its wall as close to the site of the tumor as is compatible with surgical demands. Then, by means of the index finger passed into the bladder through this opening, and the thumb outside, the extent of the second incision is determined by palpation; this second incision completes the resection and removes from the entire thickness of the bladder wall a sector which carries with it the tumor. It goes without saying that the excision will, as far as possible, be made in such a way as to facilitate the approximation of the edges of the wound. The resection, in case it does not remove more than one-third of the bladder, should be followed by total suturing of the viscus. (Fig. 8.) After the organ is closed, a cigarette drain is run down to the deepest point of the bed of the wound, the bladder is suspended to the abdominal wound, and all is closed up save for the point of drainage. The permanent catheter should never be used in cases of partial resection and subsequent complete suturing of the bladder; the patient either urinates naturally or is catheterized at appropriate intervals.

### WHEN THE URETERAL OPENING IS INVOLVED

Should the tumor involve a ureteral opening, the bladder is dissected out to such an extent that not only complete excision of the tumor base becomes possible, but also the vesical end of the ureter is laid bare. The ureter is clipped off at its insertion into the bladder, and then the exsection of the tumor base, including the ureteral mouth, is accomplished. The stump of the ureter is now reimplanted into the upper end of the excision wound, after one of the standard methods, the wound of the bladder is closed as completely as is feasible (Figs. 9 and 10), and the wound cavity attended to appropriately.

PLATE XIII.—Presented by Dr. L. E. Schmidt.

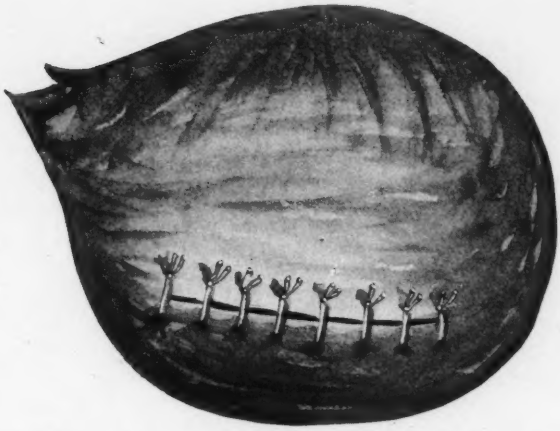


FIG. 8.—Suture line closing up wound after resection of flap out of the lateral wall of bladder.

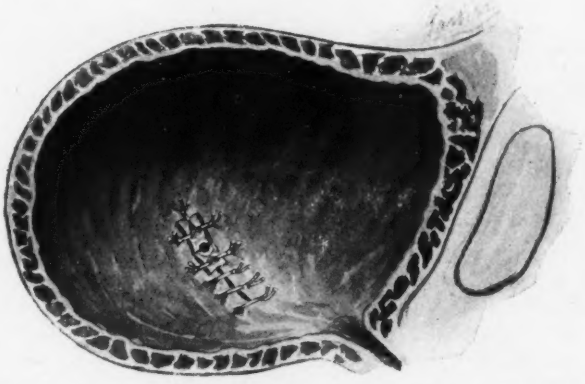


FIG. 10.—Inner aspect of the bladder showing the implanted ureter. Flap operation.

In case a more extensive resection of the bladder wall is necessary, it becomes impossible to close up the organ entirely. However, an attempt should always be made to reform the bladder, as far as possible, by suturing and by attaching the edges of the remaining portion of the viscus to the abdominal muscles. It is astonishing to observe what a small remnant of the bladder will suffice to start the formation of a serviceable organ inside of a few weeks. We have on record three cases, two cancers and one sarcoma of the bladder, in each of which more than two-thirds of the viscus was removed. After about eight weeks in each instance, all was healed over and the patient was able to retain from 250 cc. to 300 cc. of urine; the action of the bladder was perfect, the stream being projected with force, the viscus completely emptied. One is induced to believe that muscle fibers grow from the bladder remnant into the cicatricial tissue which forms over the mutilated organ, and thus impart contractile power to this newly formed portion of the bladder.

In those cases in which a radical operation is no longer possible, there are two methods of relieving the patient's suffering. One method is to open the bladder from above and cauterize the exulcerated surfaces with a Paquelin; as a rule, this intervention does not benefit the patient to any great extent, at least not for any length of time, for the urine flows into the bladder and over the excoriated and irritable surface of the tumor, and thus necessarily leads to permanent pain. The other method, which furnishes more satisfactory results, consists in establishing permanent kidney fistulæ and thus diverting the urine from the bladder; the patient is at once relieved from all pain and is made quite comfortable. A belt carrying two small pouches keeps the patient comparatively dry.

The choice of anæsthesia is of the utmost importance in all cases of bladder surgery. Endovesical operations can, as a rule, be carried on under the influence of an antipyrin anæsthesia supported by the rectal application of morphine. For the cutting operations, we always employ, as a matter of routine, the anæsthesia produced by laughing gas. This anæsthesia, besides being free from danger, so far as the heart is concerned, possesses a great advantage in that the patient returns to full consciousness immediately after the completion of the operation; this enhances

the possibilities of natural micturition, of very early breathing exercises, and of the early administrations of food and drink. Up to the present time we have never observed any untoward influence of gas-anæsthesia on the kidneys.

The next question that naturally arises is whether or not it is possible to determine, previous to the operation, the character of a bladder tumor; we do not hesitate a moment to answer in the affirmative and to say that such diagnostic work can be done with accuracy sufficient for all practical purposes. Any man with experience in cystoscopic diagnosis can recognize a benign tumor from its appearance (Nitze, Weinrich); tumors of doubtful nature are to be considered and treated as malign. In this connection it should be borne in mind that the benign papillomata comprise the majority of bladder tumors (Civiale, Thompson, Guyon, Soemmering, Kuester).

It was formerly held by a great many surgeons that, because of the poor permanent results and the quickness of the relapses, patients with malign bladder tumors should never be operated on. This view is shared at the present time by some writers. In our opinion, however, the soundness of such reasoning is, to say the least, open to discussion because, in the first place, a great many patients were and are still being operated on in an irrational manner, and, in the second place, because the diagnosis is quite often made so late that the chances for a successful operation are greatly reduced; the more general employment of the cystoscope, however, will greatly improve matters as to the latter point. Furthermore, it should be taken into consideration that the use of rational operative methods and the uniform employment of gas anæsthesia will certainly reduce the primary mortality of these procedures.

As it is, there are 2 cases of vesical cancer on record in which total extirpation of the bladder accomplished a cure without relapse for five years (Hogge), and for fifteen years (Pawlik), respectively. Rafin reports 5 cases of partial resection of the bladder for carcinoma that remained cured for more than three years. In Czerny's sarcoma case the patient lived twelve years after the operation without relapse. Quite a few surgeons report cases of malign bladder tumor which, after partial vesical resection, have remained cured for from one to three years (L. Davis,

PLATE XIV.—Presented by Dr. L. E. Schmidt.

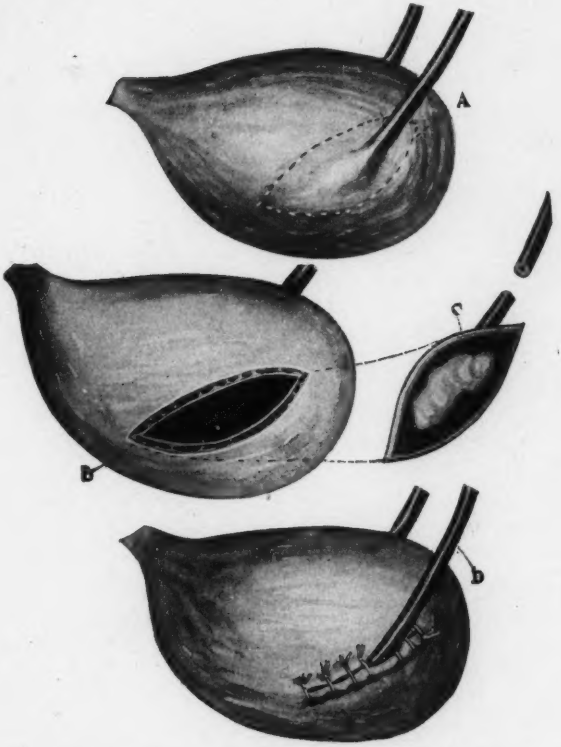



FIG. 9.—Section carrying tumor involving ureteral mouth cut out of bladder wall. A, puncture line indicating line of excision; B, bladder after excision; C, flap with tumor and ureteral stump; D, outside aspect of bladder after implantation of ureter and closing up of the excision wound.

Pousson, Pitha, Leschnew, Albarran, Alessandri, Schmidt, Kolischer).

Mikulicz, in his last publication before his death, declared that he felt convinced that he had relieved the sufferings and prolonged the life of his patient every time he had operated for cancer of the bladder. Surely so impressive a message gives warrant for our belief that, even though nothing else were accomplished than the adding of a few years of comfort to the sufferer's life, the operation would be fully justified.

## CONCLUSIONS

In conclusion we desire to submit, as the result of our work along these lines, the following fundamental propositions:

1. All benign tumors of the bladder should be approached from the inside, all malign tumors from the outside of the viscus.
2. In all malign cases in which the loss of substance is not too great the bladder should be closed completely by sutures after the removal of the tumor.
3. In cases of malign tumor the incision into the bladder should be made in accordance with the location of the growth, as defined by the cystoscope.
4. The permanent catheter should be absolutely abolished.
5. Gas anæsthesia should be employed exclusively.
6. A constant cystoscopic surveillance should be maintained over any bladder that has ever been operated on for tumor.

## DISCUSSION

Dr. ARTHUR T. CABOT, of Boston, said he wanted to thank Dr. Schmidt for bringing this subject before the Association at this time. It was a very interesting paper and worthy of full discussion, for which the time was too short.

Dr. L. BOLTON BANGS said he wished the discussion of Dr. Schmidt's paper could be arranged in such a way that more time could be devoted to it. It was a very important subject. He suggested that it be discussed at the next meeting of the Association.

Dr. HUGH H. YOUNG, of Baltimore, suggested that an effort be made to have a symposium on tumors of the bladder at the next meeting of the Association.

# THE DIAGNOSIS OF THE LOCATION OF INCARCERATED CALCULI OF THE LOWER PORTION OF THE URETER, BASED ON A NEW "SYMPTOM COMPLEX"

By Hugh H. Young, M. D., of Baltimore

DURING January, 1905, while on a trip through the West Indies, I met a gentleman who gave the following history: Fifteen months ago he began to have severe attacks of colicky pain beginning in the left side beneath the ribs and radiating from there to the left testicle. After a year the pain suddenly shifted to the region of the pelvis and was characterized by frequent desire to urinate, pain in the bladder radiating to the glans penis at the end of urination, a constant severe pain in the rectum, which was worse on defecation, a severe pain during sexual intercourse, which came on at the moment of ejaculation, and intermittent attacks of pain in the left kidney and testicle. Being unable to make an examination, I speculated as to the probable location of the calculus which I felt sure he had, and came to the conclusion that it must be incarcerated at the lower end of the ureter, where it probably projected into the bladder, and on account of its proximity to the seminal vesicle and the rectum produced the pain on ejaculation and the constant severe pain in the rectum of which he complained. After our return he came to Baltimore; to my delight a cystoscopic examination showed the sharp point of a calculus projecting from the left ureter, which was considerably enlarged in its intramural portion. Suprapubic operation was performed, the ureter divided and the calculus, about 1 cm. in diameter and 1½ cm. long, was extracted.

A glance at the anatomy of the region of the lower ureter will, I think, explain at once the raison d'être of the symptom-complex above described. The ureter at its entrance to the bladder is generally in contact with the upper end of the seminal vesicle, to which it is bound by the recto-vesical fascia. The vas deferens winds around the ureter, passing between it and the

bladder, being also in close apposition to the juxta-vesical portion of the ureter. The rectum is generally in fairly close apposition to the lower end of the ureter, sometimes being separated by peritoneum and other times not, but always lying in close proximity. It seems evident, therefore, that a stone which is lodged in the intramural course of the ureter can easily give rise to five sets of symptoms, viz:

First. Renal; due to the obstruction of the ureter.

Second. Vesical; due to the presence of the calculus in the vesical wall or projecting into the vesical cavity.

Third. Seminal; due to the intimate relationship between the seminal vesicle and the lower end of the ureter.

Fourth. Rectal; owing to the proximity of the rectum to the lower end of the ureter.

Fifth. Testicular; owing to the proximity of the vas deferens as it winds around the juxta-vesical portion of the ureter.

A calculus which has passed the brim of the pelvis is most likely to lodge either just above the bladder (the juxta-vesical portion of the ureter), or within the course of the ureter in the bladder wall (intraumural), or at the orifice of the ureter where it may project into the bladder cavity (intravesical). One would expect to find slightly different symptoms in these locations, although they are quite close together, and it therefore seems interesting to make an analytical study of cases which I have seen in regard to this point.

I find that I have histories of 7 cases, 2 intravesical, 3 intramural and 2 juxta-vesical calculi. The two intravesical incarcerations were as follows:

S. H. B., aged 31; admitted July 8, 1901. History of renal colic seven years before. No subsequent attack until six months later. Three months before admission the patient was seized by a severe pain in the region of the left kidney, which continued for several hours. Two days later the pain suddenly shifted to the neck of the bladder and was accompanied by a constant desire to urinate and pain at the head of the penis during urination. During the next three months crises of pain as above described occurred about twice in twenty-four hours, being characterized by pain in the region of the left kidney, a severe pain in the bladder, frequent desire to urinate, with pain radiating to the glans

penis. During this period he also had a slight pain in the rectum after passage of urine, and a slight pain during coitus, which came on with ejaculation and extended through the penis and also into the testicle. The cystoscope showed a small rough calculus incarcerated in the orifice of the left ureter. After several attempts it was finally dislodged by means of a ureter catheter and Casper's catheterizing cystoscope, and was passed during urination two days later. The patient was free from pain during the two days after the cystoscopy, in which the stone was free in the vesical cavity. A letter six years later says that the patient has had no return of symptoms.

CASE 2. J. A. H., aged 47; admitted April 10, 1905. Intermittent attacks of renal colic in left side characterized by severe pain which radiated to the left groin and testicle. These attacks recurred with increasing frequency and severity for a year, and then (three months ago) after a severe attack of colic in the left kidney the pain moved down the abdomen into the pelvis and was associated with a severe pain in the rectum, frequent desire to urinate, and pain during urination, which radiated to the glans penis. During the last three months these symptoms have persisted, the vesical being more or less constant and the renal symptoms intermittent. The pain in the rectum was very severe, and during intercourse there was always a severe pain in the penis during and after ejaculation. There has also been an intermittent pain in the left testicle, but it seemed to start deep down in the pelvis and radiate from there to the left testicle, and was never as severe as the pain in the rectum.

Cystoscopic examination showed a fairly large calculus incarcerated in the intramural portion of the left ureter and projecting into the vesical cavity. Suprapubic cystotomy was performed, the ureter divided longitudinally, and a sharp pointed calculus 1 x 1.5 cm. in size extracted. The suprapubic wound was closed and healed per primam. No recurrence now after three years. Sexual and rectal symptoms have not returned.

### INTRAMURAL INCARCERATIONS

CASE 3. H. G., aged 50. History of numerous attacks of renal colic in left side and the passage of six calculi. For the past

three weeks the patient has had a more or less constant pain in the pelvis associated with frequent desire to urinate, and pain radiating to the glans penis at the end of urination. There was no pain in the rectum and defecation was normal. Sexual intercourse was not indulged in during this period. Intermittent attacks of pain in the left kidney.

Cystoscopic examination showed a fusiform dilatation of the left ureter at a point about 5 mm. above the orifice. Ureter catheterization was not attempted, but the patient was given a large amount of glycerine to drink (six ounces in three doses). Two days later the symptoms suddenly disappeared and the patient passed a small oval calculus. Three years later the patient passed another calculus from the kidney, but it did not become lodged in the ureter and there were no pelvic symptoms.

CASE 4. C. L. R., No. 552, aged 28; admitted February 13, 1904. Intermittent attacks of pain in right back and right half of abdomen for eighteen months. Never any pain in the testicle, and no increased frequency of urination. During the past six months the attacks have occurred at intervals of ten days and were invariably followed by three or four nocturnal emissions. For the past month there has been a scalding sensation in the glans penis during the last expulsion of urine, and during the last week a dull pain in the right groin. On cystoscopic examination the right ureteral ridge was found enlarged, the ureteral orifice was gaping and behind it was seen a dark object which prevented the passage of a ureteral catheter more than 5 mm. beyond the orifice. Numerous attempts were made to pass a catheter and to dilate the orifice, with some success, as the calculus was passed within the next day. The patient has remained well.

CASE 5. J. B., No. 1382, aged 42; admitted September 25, 1906. Intermittent attacks of renal colic for twenty years—pain well localized in the region of the right kidney. For ten months has had a severe pain in the region of the bladder, difficulty in starting the stream of urine, pain in the head of the penis, which is worse at the end of urination. The sexual powers have remained normal except that during the act of ejaculation there is extreme pain in the penis. He occasionally has pain in the rectum during defecation.

The cystoscope showed a considerable dilatation of the in-

tramural portion of the ureter, the orifice of which was large, round, and gaping. The X-ray showed a fairly large oval stone at the lower end of the right ureter. Operation refused.

### JUXTA-VESICAL CALCULI

CASE 6. W. W. M., aged 25; admitted August 28, 1902. History of renal colic on right side for twelve years. Pain localized in right side and back. In December, 1900, after a respite of three years he had an attack of pain which began in the right testicle and travelled from there up to the kidney. After four similar attacks he was free from pain up until September, 1901. Between attacks he has felt well, with the exception of a dull pain deep down in the pelvis, which he says is in the region of the bladder and worse at the end of urination, but never radiating to the penis. No note as to rectal or ejaculatory symptoms. The cystoscope showed normal ureters, but a ureter catheter met an impassible obstruction about 4 cm. above the orifice. X-ray plates showed a calculus just above the bladder, which was extracted by extra-peritoneal iliac uretero-lithotomy. The calculus was incarcerated at a point 1.5 cm. above the juncture of ureter to bladder, and was surrounded by considerable fibrous adhesions. The ureteral wound was sutured and healed per primam. No subsequent symptoms.

CASE 7. W. B., aged 29; admitted August 28, 1901. Since infancy patient has suffered with a dull aching pain in the region of the bladder and a sore feeling in the region of the left kidney, and at intervals of two weeks attacks of pain beginning in the neck of the bladder and radiating to the glans penis occasionally associated with severe pain in the left lumbar region. No testicular, rectal, or ejaculatory symptoms. No increased frequency in urination. On cystoscopic examination the left ureteral ridge was found considerably enlarged, the orifice pin-point in character, and ureteral catheter was obstructed at a point about 1.5 cm. above the orifice. X-ray photographs showed a large oval calculus in the lower end of the right ureter. Left inguinal extra-peritoneal uretero-lithotomy was performed and a calculus 1.5 cm. in diameter and 2 cm. long extracted at the pelvic brim. A tight stricture of the intramural portion of the ureter was present,

and was divided through an opening in the left half of the bladder. Bladder and ureter above sutured, healing per primam. No recurrence.

A study of the above cases shows that when the stone is situated in the ureter above the bladder the symptoms are pain in the pelvis, sometimes radiating to the penis, but not associated with increased frequency of urination nor with pain in the rectum nor on ejaculation. Intermittent renal colic occurs, and perhaps pain in the testicle. When the stone is situated in the intramural portion of the ureter and does not project into the cavity of the bladder, there may or may not be frequency of urination, but there is always a pain radiating into the penis at the end of urination, and there is generally some ejaculatory disturbance—either nocturnal emissions or pain during ejaculation. Pain was present in the rectum in one of the three cases. Intermittent attacks of renal colic occurred.

In the two cases in which the stone was incarcerated in the ureteral orifice and projected into the bladder, the symptoms were more severe than in any of the others, and presented a typical symptom complex, renal, vesical, rectal, seminal, and testicular, as above described.

## Third Day, May 9th, 1907

Joint Session of Genito-Urinary Surgeons, and the American Gynecological Society

## SOME CONGENITAL VARIATIONS OF THE KIDNEYS AND URETERS, IN REFERENCE TO THEIR DEVELOPMENT AND SURGICAL IMPORTANCE[1]

By George H. Huntington, M. D., of New York

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## RADIOGRAPHIC DIAGNOSIS OF RENAL LESIONS

By Lewis Gregory Cole, M. D., of New York

SINCE the more general practice of nephrotomy has demonstrated the difficulty of diagnosing cases of renal calculi with any degree of certainty, the demand for a more positive method has been apparent, and the discovery of Röntgen, twelve years ago, was at once eagerly seized upon as furnishing this method.

Radiographs of favorable subjects were made showing these lesions, and reports of these cases were heralded around the world, creating in the minds of the over-sanguine the erroneous impression that the X-ray furnished a simple and infallible solution of the problem.

With the generally limited knowledge of the science then possessed, physicians, surgeons, and instrument-makers at once provided themselves with X-ray equipments and undertook to make radiographs of renal calculi with what would now be regarded as crude apparatus.

[1] The paper is to be published by The Harvey Soicety.

As a result radiographs were made, giving shadows which were interpreted as calculi, but which in many cases were not sufficiently distinct to justify a positive diagnosis, and in none of these early plates was there sufficient detail to warrant a negative diagnosis. Such diagnoses were, however, frequently made, and in many cases proved erroneous, with the result that this method fell into disrepute and it is with considerable difficulty that it is becoming reinstated in its proper place.

Three years ago this spring, after making a number of satisfactory radiographs of the renal and ureteral region, I read a paper before the Genito-Urinary Section of the New York Academy on the negative and positive diagnosis of renal and ureteral calculi by the ray of selective absorption, and demonstrated some plates which showed calculi distinctly where the diagnosis had been verified by operation, and others which showed the psoas muscle and the tips of the spinous process distinctly enough to justify a negative diagnosis.

In some of these cases the symptoms of renal calculi were so characteristic that the operation was performed, and in only one case was a stone found that was not shown in the radiograph, and in that case the plate did not extend high enough up to include the area of the pelvis of the kidney, where the stone was found on operation.

This success continued until the two tubes I was using gave out, and with new tubes the results were not nearly so satisfactory, and for several months it was with great difficulty that I obtained radiographs with sufficient detail to justify a negative diagnosis.

During the winters of 1904 and 1905 I devoted much time to experimental work on the ray of selective absorption, and the results of this line of work are fully described in the *Archives of Röntgen Ray*, May, 1905, and further experiments along the same line in the *Archives of Physiological Therapy*, or in the *Transactions of the American Röntgen Ray Society*. In brief, this resulted in the separation of the X-ray into three distinct varieties:—

First. The direct ray.

Second. The indirect ray.

Third. The secondary or Sagnac ray.

The purely direct ray, when it can be obtained, gives on a well-timed and properly developed plate the greatest amount of detail, not only the structure of the bones, but the muscles, fasciæ, fat, and even the blood in the veins show very distinctly.

The indirect rays from the average tube are equally as powerful and abundant as the direct rays, and their effect is simply to fog the plate and obscure the detail of the direct rays. It has been demonstrated by Professor J. J. Thomson that the secondary or Sagnac rays are generated in and emanate from all substances under the action of the X-ray in inverse proportion to the density of the substance, and I am convinced by my own experiments that they are produced to a greater extent by the indirect than the direct rays, and the effect upon the plate is detrimental in the same manner as the indirect rays.

*Compression Blend.*—The use of a diaphragm or compression blend cuts off the indirect rays to some extent and helps very materially in obtaining good radiographs of the renal and ureteral region, but it does not convert any greater percentage of the energy into direct rays.

With an apparatus so constructed that you have a preponderance of direct rays, and using a compression blend to eliminate the indirect rays and limit the field in which the secondary rays are generated, we can obtain enough detail to enable one to make a negative or positive diagnosis of renal or ureteral calculi of sufficient size to justify an operation.

*Technique.*—The patient should be prepared for the radiograph by thorough cathartics the night previous and an enema just before the exposure is made. This is especially important when the patient is constipated and the stools are hard and dry. The bladder should also be empty.

*Diet.*—It is desirable that only a light breakfast should be eaten, and that the stomach should be empty before the radiograph is made.

*Clothing.*—The clothing should be removed from the part of the body to be radiographed, not that the clothing interferes so much with the rays, but they are likely to contain buttons, hooks, and eyes, or pins that might lead to a misinterpretation of the negative.

*Position.*—The patient then lies with his back flat on the

table and the thighs flexed so that the small of the back is in contact with the plate. Raising the head or shoulders sometimes assists in securing this position.

*Large Plate for Genito-urinary Tract.*—If one large plate is to be used to include both kidneys, both ureters, and bladder, the tube is placed vertically over the umbilicus, twenty or twenty-two inches from the plate.

*Size of Plate.*—A 11 x 14 inch plate is the smallest size that will include both kidneys, ureters, and bladder, and if the patient is tall this is not large enough. Just previous to adjusting the plate under the patient is it well to test the tube. As the kidney moves from one-half to two inches during respiration, the patient should hold his breath during the exposure, otherwise the shadow of a calculus will appear ill defined and indistinct, and if very small will appear as a blurred line.

*Exposure.*—The time of exposure varies from ten to thirty seconds, according to the size of the patient and condition of the tube. The radiograph should include the eleventh and twelfth vertebræ and ribs above, and extend about one inch beyond the tip of the coccyx below.

*Compression Blend.*—Much more detail may be shown when a compression blend or diaphragm is used. The compression blend not only compresses the parts and holds the patient quiet, but it also prevents to a large degree abdominal breathing. At the same time it so limits the area exposed that its use requires five radiographs to show the entire genito-urinary tract, one for each kidney and the upper part of the ureter, one for each ureter, and one for the bladder and lower part of each ureter.

*Renal.*—The radiograph of the kidney region should show the eleventh and twelfth ribs and the first, second, and third vertebræ (lumbar).

*Ureteral.*—The ureteral radiographs extend from the third lumbar vertebra to the brim of the pelvis.

*Bladder.*—The radiograph of the pelvis includes the pubis below and extends up as far as possible.

*Full Set of Plates.*—The necessity of making a full set of plates cannot be too strongly urged. An oculist would not limit his examination to one eye, or an aurist to one ear, nor would a diagnostician make a physical examination of one side of the

chest, even although all the pain was on that side. Why should a radiographer make a radiograph of one kidney?

In a number of cases which I will mention later, calculi have been shown on the opposite side from which the pain occurred, or calculi have been present on both sides and only given symptoms on one. If an opinion is desired as to the size, shape, position, and density of the kidney, then surely a radiograph of both kidneys is necessary for comparison.

*Interpretation of Plates.*—The interpretation of the plates is more important and more difficult than making it, and lack of care and experience in this is the cause of most of the errors that have been made in the diagnosis of renal and ureteral calculi by the X-ray.

A person unfamiliar with woodcraft is astonished at the way an old hunter can follow the track of an animal in the woods, yet when his attention is called to the barking of a fallen log, the slight imprint in the ground, the turned leaf or broken twigs, etc., they are all apparent. It is much the same in reading X-ray plates, the shadows are there and anyone can see them when they are pointed out.

It requires a careful study and comparison with other plates by a trained eye to detect slight shadows, and it requires experience to determine whether they are due to calculi or one of many other things which I will mention later. This has been especially impressed upon me during the preparation of this paper, when I have studied nearly fifteen hundred plates, made during my practice, some of the earlier ones showing shadows of what I then failed to recognize as possible calculi, requiring repeated exposures for verification.

It is unwise to make a diagnosis on a wet plate because drops of water and the glistening of the wet surface interfere with the detail. The plate should be allowed to dry slowly, and the back of the plate thoroughly cleansed and polished. It should then be carefully studied and compared with other plates in a good even light. Some prefer an illuminating box where the light can be controlled with a rheostat, but personally I prefer a northern sky or daylight with a ground glass, holding the plate in my hands so that it may be tilted at different angles to show finer gradations of the shadow.

One is not justified in making a negative diagnosis of renal or ureteral calculus unless a plate of the renal region shows the following detail:

First. The spine and transverse processes should show distinctly all the way to the tip.

Second. The outer border of the psoas muscle must show. In some very flabby, fat patients it may not show as distinctly as the kidneys.

Third. The eleventh and twelfth ribs should show distinctly, and in many cases the bony detail may be distinctly seen.

Fourth. In about 75% of the cases the kidney may be seen more or less distinctly, and if special care in technique is used it may be shown in nearly every case.

Fifth. The liver is frequently seen, and at times it interferes with showing the convex surface of the upper pole of the right kidney.

Sixth. The spleen also may be seen, especially if it is enlarged or congested.

Seventh. Accumulation of gases in the colon and small intestines appear on circumscribed areas, and folds in the walls of the intestines are often seen traversing these areas.

Eighth. Fæces in the intestines, especially in the colon, show very distinctly (Cook), and interfere very materially with the diagnosis of renal lesions.

*Ureteral.*—The plate of the ureteral region should include the third, fourth, and fifth lumbar vertebræ and part of the sacrum and ilium. The bony detail should show distinctly, and the sacro-iliac synchondrosis should be well defined. The outer border of the psoas muscle is clear, and the accumulation of gas and fæces are frequently seen in the coccum or segmoid. The course of the ureter is about on a line with the tips of the transverse processes and at the sacro-iliac synchondrosis. Calcified arteries are sometimes seen in the plates.

*Pelvis.*—This plate shows the pubes, bony structure of the spine of the ischium, sacrum, and coccyx all the way to the tip. The bladder distended with urine is sometimes well marked, also when injected with collargolum.

*Diagnosis.*—Up to the present time the radiographic diagnosis of the genito-urinary tract has largely been limited to the

negative or positive diagnosis of renal, ureteral, or vascular calculi. We will therefore consider this subject first.

After having made and carefully studied about 1,500 plates of the genito-urinary tract in about 500 cases, I believe that a plate having the above described detail will show any variety of renal, ureteral, or vascular calculi of sufficient size to justify an operation, that is, one that is too large to pass.

In view of the fact that some of the best authorities disagree with me in this statement, it is with reluctance that I make it, but after carefully experimenting with the softest calculi that I could obtain, and in one case using the very stone it was claimed would not show, I am convinced that I am justified in making this statement. I placed the stone behind a patient and made an exposure and it showed very distinctly. This, of course, is much easier than if it were in the kidney. I then placed it on the abdomen of a large man and it showed distinctly. This was much more difficult than showing it in the kidney, because the further the calculus is from the plate, the less distinct it is. Not satisfied with this, I imbedded this calculus in paraffin and placed it behind a patient the same distance from the plate that it would be if it were in the kidney, and it showed distinctly.

In some cases the calculi are so distinct that there is no difficulty in making the diagnosis. In others, however, it requires the careful study of several confirmatory plates to differentiate between calculi and the following:

1. Fecal concretions.
2. Gall-stones.
3. Calcified costal cartilages of the eight and ninth ribs.
4. Spiculæ of bone or osteoplaques.
5. Small calcarious bodies, or so-called phleboliths.
6. Folds of intestines.
7. Enteroliths.
8. Foreign bodies in intestines.
9. Calcified arteries.
10. Calcified lymphnoids.
11. Prostatic calculi.
12. Finger marks.
13. Developing stains from uneven flood of developer.
14. Flaws in plates.

15. Tuberculous kidney.
16. Shot in back.
17. Unknown.

1. *Fecal Concretions.*—We are most frequently called upon to differentiate between the shadows of calculi and those of fecal concretions, and it is unwise to make this differentiation on one plate.

| CALCULUS | FECAL CONCRETIONS |
| --- | --- |
| If the patient has held his breath the edges of the calculus will appear clear-cut and well-defined. The shadows are more dense for their size, and are only seen in the region of the kidney or ureter, and the most important thing is to give time for fecal concretions to move out of the field or change position, and if the shadow remains in the same place it is not fecal concretion. | The edges of the shadow are ill-defined, and the shadows less dense than that of calculi of the same size. They are usually multiple, and at least some are not in the region of the kidney or ureter, and if time is allowed to elapse between exposures, and a cathartic and enema are given, the concretion changes is place or disappears entirely. |

2. *Gall-stones.*—Gall-stones may be shown with patients on back, but are more clearly defined when patient lies with abdomen flat on the plate. The reverse is true of renal calculi. Shifting the tube slightly changes the position of the shadow of the gall-stone more than it does the shadow of the kidney stone.

3. *Calcified Costal Cartilages of the Eighth and Ninth Ribs.*—The calcified costal cartilages of the eighth and ninth ribs resemble renal calculi very closely. They may appear in the kidney in the same positions in repeated exposures. There is usually more than one area, and gives the appearance of a calcarious deposit throughout the kidney more than an isolated calculus, or two or three calculi, and are usually bilateral. They may be definitely differentiated from calculi by having the lip of the compression blend under the free border of the ribs, therefore whenever the shape of a person is such that the compression blend must be on

top of the free border of the ribs in order to include the renal region, these shadows must be differentiated from calculi.

4. *Osteoplaque or Spicula of Bones.*—In cases of osteoarthritis of the vertebræ, the osteoplaques may resemble ureteral calculi. They are a trifle nearer the spine than the normal course of the ureter, and the other changes of the spine, such as lipping and destruction of the cartilages, are always present.

5. *Small Calcarious Bodies, or so-called Phleboliths.*

| CALCULUS | CALCIFIED BODIES |
|---|---|
| Usually single and only on one side. If multiple they are arranged in lines which correspond with the course of the ureter, usually are irregular and have rough edges. If they are round or small with rough edges, they change position between exposures with attacks of renal colic and blood in urine. They must be in line with the course of the ureter. | Calcified bodies near the lower end of ureter usually are multiple and on both sides. When multiple they are arranged in a line running in the opposite direction to the course of the ureter. They are round with smooth edges, and so small that were they calculi they would pass or change position between exposures. Usually they are one-fourth to three-fourths of an inch to the outer side of the ureter. |

Ureteral catheterization, which is discussed later, aids very materially in differentiating these conditions.

6. *Folds of Intestines.*—These are not as well defined as calculi; usually seen only accompanied by accumulation of gas and appear as long narrow shadows instead of the shape of calculi. Unless the fold is permanent and held in place by adhesions, it does not appear in confirmatory plates.

7, 8. *Enteroliths and Foreign Bodies.*—Enteroliths and foreign bodies change their position. A Murphy button for intestinal anastomosis viewed edgewise might readily be mistaken for a large calculus, but sooner or later it would show the hole in the center.

9. *Calcified Arteries.*—Calcified arteries usually show the

form of the artery and are not in the position of the kidney or ureter.

10. *Calcified Lymphnoids.*—Calcified lymph glands, especially those in the pelvis, resemble calculi very much. They usually, however, are multiple and not in line with the normal course of the ureter.

11. *Prostatic Calculi.*—Prostatic calculi are further down than ureteral or vascular calculi, and more closely resemble phleboliths.

12. *Finger Marks.*—Finger marks during developing of the plates might readily be mistaken for stone.

13. *Developing Stains from uneven flood of Developer.*—Irregular flooding of the plates during developing may leave a small area that resembles a stone.

14. *Flaws in Plates.*—Slight flaws in plates came as near causing me to make an error as anything I have seen. The case I have in mind appeared as a small, well-defined, round shadow with clear-cut edges, exactly in the line of the ureter and about the place the patient had complained of the greatest pain. Up to this time I had only made confirmatory plates in doubtful cases, and this did not appear to be a doubtful case, but fortunately a confirmatory plate was made and the spot had disappeared and on closer study one could see it was a flaw in the plate.

15. *Tuberculous Kidney.*—The diagnosis between an old calcified tuberculous kidney and a renal calculus is sometimes very difficult. Usually the shadow of the tuberculous kidney is less dense and its edges not so clear cut and well defined. Fortunately the differential diagnosis between these conditions is not so important because the treatment for each is the same.

16. *Shot in Back.*—Shot in the muscles of the back are more distinct and the edges more clear cut than calculi.

Aside from these possible mistakes, we find well-defined permanent lesions which I have been unable to diagnose, and some of these plates I will show.

*X-ray versus Exploratory.*—Anyone who has hunted for a needle in a finger, even after a radiograph has shown its presence and apparently its exact position, realizes how difficult it is to find a foreign body. The finger is much smaller than the kidney, there is nothing to prevent cutting in all directions, hemorrhages

may be prevented and all the circumstances most favorable, yet few persons except radiographers know how prolonged and unsuccessful the operation for foreign bodies frequently are. How often you hear this phrase: "The X-ray showed a stone, but none was found on operation." No one would question for a minute the fallacy of the exploratory operation, especially if the kidney was split and the calices explored with the finger. The following cases would show the relative value of X-ray and exploratory:

The writer radiographed a case and made a diagnosis of five calculi, a large one in the pelvis and four small ones apparently in the calices, and an operation was performed by a very careful surgeon. The kidney was split and the large stone was found. A thorough search was made by the surgeon and his assistant for the small ones. The calices were explored with the finger of each of the operators. Assuming that the nodules on the calculus were what had been interpreted as four small calculi, they informed me that my diagnosis on the large calculus was all right, but that there were no small ones present. About six weeks later the patient had a severe attack of renal colic and passed four of the largest stones that could possibly pass. The large stone was in such a position that the small ones could not possibly have slipped past into the ureter before or during the operation.

A number of cases are on record where the calculus had been shown in radiographs, and not been found on operation, but later the diagnosis has been verified by removal of the kidney when the calculus has been found. Are the surgeons justified in saying that the calculi are not present after an exploratory operation, when a satisfactory radiographic examination and positive diagnosis have been made?

*Catheterization versus X-ray in the Diagnosis of Renal and Ureteral Calculi.*—Comparing the relative value of catheterization and X-ray, so much depends on the technique of the one and the dexterity with which the other is performed, that we will only compare the results of the best of each. Each have their dangers.

In X-ray there is the danger of the so-called burn, but with the short exposures of thirty to fifty seconds this is practically eliminated. The danger of infection and shock from ureteral catheterization you are in a position to know better than I am; and the discomfort, to say the least, well, the patient is the best

judge of that, and most of them have had very decided views on this subject.

As to their value, each has its place. Many things can be determined with the catheter that cannot be with the X-ray, but in the diagnosis of renal calculus, if you cannot find a stone in the kidney when it is split open by examining each calix with your finger, how do you expect to make a negative diagnosis of calculus at the other end of a catheter sixteen inches long? And with what certainty can one say that he touches a stone in the pelvis of the kidney? In the diagnosis of ureteral calculi the catheter is of more value than in renal, as one can say with certainty that he meets with an obstruction so far from the bladder, and with wax tips or other devices in some cases may be reasonable sure it is a stone, but whether it is small or large, smooth or rough, and whether it will move or not, it is impossible to say.

A radiograph will show the size, shape, position, and with a little experience one can tell whether they will pass or not. A small, rough one will lodge, while a smooth one of astonishing size will pass. On the other hand, small calcified bodies near the lower ends of the ureters, called by many phleboliths, are frequently mistaken for calculi. The characteristic differences between these are described early in this paper, but a combination of catheterization and X-ray is of greatest value, using a styleted catheter and making a radiograph.

As I said, these phleboliths are usually about one-half to three-fourths of an inch to the outer side of the course of the ureters, but sometimes directly in line with the ureters, and in the X-ray appear to lie against the catheter. It is wise to make two radiographs at different angles to prevent this source of error.

*Do Calculi Perforate or Migrate through the Walls of the Ureter?*—The first case of ureteral calculus that I radiographed showed a well-marked shadow at the lower end of the ureter, oval in shape and about one cm. long. It appeared in several plates. Ureteral catheterization showed no obstruction at this point. An exploratory operation was performed, and on palpation no calculus could be felt. The ureter was opened and a catheter was passed into the bladder without meeting with an obstruction. At that time I was not familiar with so-called phleboliths, and insisted there must be a calculus, so just before closing the wound

a further search was made and the calculus was found in a pocket it had formed in the ureter just before it passes into the bladder. It was pushed out of the pocket into the ureter and out of the opening near the kidney.

In another case a calculus was found to be imbedded in the walls of the ureter, and Dr. Keyes told me of a case where a stone containing urinary salts was found in the abdominal cavity. In another case the catheter met with an obstruction about one and one-half inches from the ureteral orifice. The case was radiographed at the patient's request to ascertain the size and shape of the stone and the possibility of its passing. No calculus was shown at this point, but there was a well-defined one in the kidney.

One of the most important points that the writer has to make is, that many of the cases having typical attacks of renal colic do not have a stone in any part of the genito-urinary tract, and when a calculus is shown, it is usually so small that it will pass without an operation other than ureteral catheterization.

On the other hand, only a few of the cases in which renal calculi have been demonstrated by X-ray have had symptoms that were sufficiently characteristic to justify an operation, and of those few only those that engage in the ureter or obstruct the pelvis cause typical renal colic. They may have pain either in the back or side, especially on jolting or riding in a car, tenderness over the kidney, dull aching, or especially what is described by them as a sense of weight or heavy feeling in the back.

A great many of the cases diagnosed as lumbago, or rheumatism of the back, have renal calculi. Whether the calculus is the cause of the lumbago, or the lumbago the cause of the calculus, is not for me to decide.

Calculi giving symptoms of chronic appendicitis are very common. Several of the cases in which calculi have been demonstrated were diagnosed as appendicitis, and radiographs have been made just to eliminate the possibility of calculus. This has occurred in so many cases that some physicians are having nearly all cases of obscure abdominal lesions radiographed. The wisdom of this is particularly shown in the following cases:

A woman fifty years of age complained of symptoms which were diagnosed as appendicitis (chronic). She traveled a great deal both in this country and abroad, and her hobby was to get

the opinion of the best authorities in every country, and, strange as it may seem, they nearly all agreed that it was appendicitis in some form or another. She finally came under the care of a physician who had many of his obscure abdominal lesions radiographed, particularly those of appendicitis, to differentiate them from renal calculi. This case had a stone in the pelvis of the kidney, and repeated urinary analysis had given no indication of stone.

Ten or eleven of the fifty-four cases in which I have demonstrated renal calculi have complained of all the pain, or the most severe pain, on the opposite side from that on which the calculus was found. This is such a peculiar fact, requiring a detailed history of each case to make it complete, that it seems unwise to incorporate it in this paper; I therefore merely mention it here to show the necessity of making radiographs of both sides.

Besides making a positive or negative diagnosis of renal or ureteral calculi, much information may be gained by a radiograph having sufficient detail to show the kidney distinctly. The density, shape, size, and position may help very materially in making the diagnosis of tuberculosis, new growth, prolapse, and congestion of the kidney, and ascertaining the presence of the kidney on the opposite side.

The kidney may be seen more or less distinctly in about 75% of the cases, and if special care in technique and selection of tubes is used, it may be shown in nearly every case. Strange as it may seem, the size of the patient has very little influence, indeed, in large, fat persons it is more frequently seen than in thin ones. This may be accounted for by difference in density between the kidney and fat it is imbedded in; the more fat the greater this difference is. The soft tissues of some patients are much more dense to the rays than others, and where this is so the kidney shows very distinctly compared with the spine, which in these cases shows indistinctly.

The repeated appearance of one kidney and not the other, or the increased density of one compared with the other, or with the psoas muscle, indicates a change in the kidney, and if this density is uniform and the kidney is not mottled, it is due, probably, to congestion of that organ. If the kidney appears mottled or of irregular density, it would indicate tuberculosis or new growth,

and if the contour of the kidney is changed in addition to the irregularities of density and mottleness, it increases the probability of new growth. Several confirmatory plates are necessary and these shadows must be differentiated from the same things calculi are—particularly fecal accumulations.

*Size.*—The size of the kidney compared with the opposite one may be fairly accurately determined, but it must be remembered that it is slightly enlarged in the radiograph. The amount of this depends on the distance of the X-ray tube from the kidney, and the distance of the kidney from the plate. In a person of ordinary size with the tube eighteen inches from the plate, the radiograph represents the kidney about one-half to three-fourths of an inch larger than it really is. In some cases the pelvis of the kidney and the ureter show distinctly, but it is doubtful if this is of any pathological significance, unless it is thickened and irregular, which would indicate tuberculosis.

The position of the kidney at the time the radiograph is made may be demonstrated very accurately if the position of the tube is considered. If the kidney is shown to be out of place, the diagnosis of floating kidney is positive; but if it is shown to be in its normal place, it does not indicate that it is not movable, as the position of the patient, and particularly the pressure of the compression blend, tend to cause it to assume its normal position.

*Résumé.*—The principal points that should be remembered are:

With a limited knowledge of the science, radiographs have been made which did not have sufficient detail to justify a negative or positive diagnosis, and persons without sufficient experience have made negative or positive diagnosis on these plates.

The separation of the X-ray into three varieties. The value of the direct in radiography and the detrimental effect of the indirect and secondary.

The interpretation of the plate is more important and more difficult than making it.

The amount of detail necessary for a negative diagnosis.

Technique, diet, clothing, catharsis, position, exposure, etc.

Necessity of making full set of plates.

Reasons for believing that one is justified in making a negative diagnosis of calculus when above described detail is present.

Things calculi must be differentiated from.

X-ray versus exploratory in the diagnosis of calculi.

X-ray versus ureteral catherization in the diagnosis of calculi.

Most cases having typical attacks of renal colic do not have stones, and on the other hand only very few of the cases which have calculi have symptoms sufficiently characteristic to justify an operation.

Similarity of symptoms of chronic appendicitis and renal and ureteral calculi.

About one-quarter of the cases in which calculi are found have the most pain on the opposite side.

Value of the X-ray in the diagnosis of tuberculosis, new growths, and nephroptosis.

One cannot expect any great amount of success in renal radiography when work requiring so much attention to detail is turned over to hospital orderlies, nurses, even physicians without any training or experience along this line.

## SURGICAL CONDITIONS OF THE KIDNEYS. WITH REPORT OF PERSONAL CASES

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THE object of this report is to present a series of specimens illustrating various classified surgical conditions of the kidney, which specimens have been collected from cases personally operated upon.

A review of their clinical histories will serve to impress what is already known: that there is a wide departure from stereotyped lines in the symptomatology of many kidney cases, and that accurate diagnosis is possible only by careful preliminary study in each instance.

Chart I gives a general classification of the surgical maladies of the kidney including (1) acute infection of the kidney, or what

is known as acute surgical kidney, represented in multiple foci or minute abscesses throughout the organ; (2) the more advanced condition of surgical kidney, pyelonephritis, being an inflammation involving the pelvis and parenchyma, and (3) the final condition of surgical kidney, pyonephrosis—nephritic abscess involving, more or less, the entire organ, often transforming it into a sac of pus.

When the same pathological conditions occur with the tuberculous element implanted thereon, corresponding to the multiple foci, we have miliary tubercles; instead of the ordinary pyelonephritis, tuberculous pyelonephritis, etc.

The same inflammatory conditions and a foreign body as the causative factor, or the presence of calculus or calculi, we define as the pyonephritic and pyonephrotic stone kidney; and, in distinction from this composite condition is calculus in the kidney with none of the conditions attendant upon inflammation, renal lithiasis without infection. There is also hydrops of the kidney, or hydronephrosis, caused by obstruction to the ureteral channel, and, finally, the neoplasms of the various types.

CHART I OF SURGICAL CONDITIONS OF THE KIDNEY

I. *Aseptic*
1. Neoplasms
2. Calculi
3. Nephroptosis
4. Ureteral obstructions { (a) Hydronephrosis; (b) Passive congestion
5. Trauma { Rupture with severe hemorrhage; Secondary inflammation

II. *Septic*
1. Acute infection of kidney (multiple abscess foci)
   (a) Ascending
   (b) Tuberculous
   (c) Other hematogenous infections
2. Pyelitis and pyelonephritis
   (a) Ascending
   (b) Calculous

(c) Obstructive
(d) Tuberculous

3. Pyonephrosis
(a) Ascending
(b) Calculous
(c) Obstructive
(d) Tuberculous.

Chart II is a synopsis of cases reported, and contains a suggestive method of investigating cases and of keeping useful records.

The study of the symptomatology of different cases brings out the variation in symptoms and the importance of applying the different diagnostic methods for investigation, namely, cystoscopy, radiography, and careful laboratory technic, by means of which we are enabled to make a rational interpretation of the existing symptoms and a precise localization of the suspected lesion, either by positive evidences or by a process of elimination, before resorting to operative measures.

CHART II—SYNOPSIS OF CASES

| *Condition* | *Symptomatology* | *Diagnosis* | *Operation* |
|---|---|---|---|
| 1. Renal lithiasis<br>Stone kidney<br>without infection | Pain<br>Hematuria<br>Urination | Palpation<br>Cystoscopy<br>X-ray<br>Laboratory | Nephrotomy or<br>nephrectomy |
| 2. Renal lithiasis<br>with infection<br>Pyonephritic<br>Stone kidney | Pain<br>Hematuria<br>Pyuria<br>Urination | Palpation<br>Cystoscopy<br>X-ray<br>Laboratory | Nephrotomy or<br>nephrectomy |
| 3. Pyonephrotic<br>Stone kidney | Pain<br>Hematuria<br>Pyuria<br>Urination | Palpation<br>Cystoscopy<br>X-ray<br>Laboratory | Nephrotomy or<br>nephrectomy |
| 4. Tuberculosis of<br>the kidney | Pain<br>Hematuria<br>Pyuria<br>Urination | Palpation<br>Cystoscopy<br>X-ray<br>Laboratory | Nephrotomy or<br>nephrectomy |

| | *Condition* | *Symptomatology* | *Diagnosis* | *Operation* |
|---|---|---|---|---|
| 5. | Trauma of the kidney | Pain<br>Hematuria<br>Collapse | Palpation<br>Exterior signs of injury | Nephrotomy or nephrectomy |
| 6. | Miscellaneous types simulating previous conditions | Pain<br>Hematuria<br>Pyuria<br>Urination | Palpation<br>Cystoscopy<br>X-ray<br>Laboratory | Exploratory<br>Nephrotomy |

CASE 1. *Multiple Renal Calculi.*—January 29, 1906; ———, aged 18.

*Symptoms.*—(a) Pain. Complains of pain in the right lumbar region, which does not radiate toward the testis nor in any other direction. This pain is worse in the morning on waking; increases somewhat with exercise and after drinking alcoholic stimulants. The patient states he is free from pain in the afternoon and that it sometimes returns when he is reclining in bed, but is never sufficient at this time to waken him. Hence the pain does not bear a direct relation to the muscular activity or rest of the body. The duration of the pain is thirteen years.

(b) Hematuria. The patient remembers having passed blood in the urine when he was very young, and again when he was about 9 years old. He states that he has passed it about five times since then, and on each occasion about one-half cupful mixed with urine. Between times the urine has been perfectly clear.

(c) Urination. He urinates about every two hours by day, but does not rise at night; no increased frequency with exercise; no pain on urination.

*Previous History.*—Denies venereal disease and has never had night-sweats or protracted cough.

*Family History.*—Father died from pulmonary hemorrhage, alleged to have been brought on by drinking. Mother alive and healthy. Paternal grandfather had "asthma" and died from lung trouble. Two brothers died in early infancy, one having a severe cough. There are seven healthy children, including himself, living.

*Physical Examination.*—Palpation negative; cystoscopy negative; X-ray negative.

*Urinary Examination.*—Urine is practically clear; shows

slight trace of albumin; acid; no epithelium; no pus; occasional blood-cell; crystals of oxalate of lime.

*Operation.*—February 2, 1906. Lumbar nephro-lithotomy. Ten irregularly shaped stones are removed from the right kidney. Some are round, with flat bases, and others are jack-straw shape; weight, 70.77 grams; composition, uric acid and oxalate of lime. Patient makes an uneventful recovery and leaves the hospital at the end of ten days.

*Remarks.*—The important features of this case are found in the preliminary history, which suggested either tuberculous or calculous kidney, and the negative X-ray diagnosis.

CASE 2. *Pyonephritic Stone Kidney.* ———, aged 45.

*Symptoms.*—(a) Pain entirely associated with urination, which was frequent and difficult.

(b) No hematuria; marked pyuria.

(c) Urination every hour by day; two or three times by night. Fifteen years back, specific urethritis.

*Physical Examination.*—Filiform stricture of the bulbomembranous junction. Urine freely purulent forming bulky deposits; foul odor; some hyaline casts and normal urea output. No renal pain; palpation negative, patient being very fleshy.

*Operation.*—Perineal urethrotomy. No reduction of pus in the urine followed operation.

Cystoscopy through perineal opening. Chronic cystitis; both ureteral orifices swollen. The urinary jet from right side distinctly cloudy. Field of vision quickly obscured. Left side showed nothing. No X-ray. Calculi not suspected.

*Second Operation.*—Right kidney explored by lumbar incision. Kidney found enlarged and adherent, and presence of calculi recognized. The cortex was split and the stones removed one by one, until twelve had been extracted, and two which had evidently migrated through the cortical surface were found in the perirenal tissue. Patient made a good recovery. (See Figs. 13 and 14.)

*Remarks.*—Symptoms all vesical and urethral; no vesical pain or hematuria; palpation impossible. Diagnosis made by cystoscopy; X-ray not employed. Nephrotomy instead of nephrectomy as, although the kidney was much damaged, there was no general septicemia, and the competency of the opposite kidney had not been satisfactorily established.

CASE 3. *Pyonephrotic Stone Kidney.*—(Fig. 1.) ———, aged 40.

*Symptoms.*—(a) Pain of dragging character in the right infracostal region associated with movable body in the right abdomen. Pain varied with the appearance and disappearance of movable body. Ten years previously operation had been performed and a small calculus removed from the right kidney; since when the pain has been as described, associated with the movable body.

(b) No hematuria.

(c) Urination slightly more frequent than normal. Urine freely purulent; contains bacteria and some albumin; urea output normal. Microscopically, cells from renal tubes seen.

*Physical Examination.*—Right kidney palpable and usually movable; not markedly tender. X-ray picture reveals the presence of two stones, one involving almost the entire pelvis.

*Operation.*—Kidney exposed and found to be little more than a pus sac containing stones. Nephrectomy.

*Remarks.*—Symptoms distinctly renal; pain and pyuria. X-ray diagnosis positive. Cystoscopy not performed to estimate the opposite kidney, but on account of the showing of the urinary examination, together with the existence of nothing more than a pus sac on one side, the presumption of the competency of the opposite kidney is fairly established. Nephrectomy is performed both on account of the small remnant of kidney structure and in order to shorten convalescence, the patient being in bad general condition.

CASE 4. *Pyonephrotic Stone Kidney.*—(Figs. 2 and 3.) ———, aged 13; February 1, 1907.

*Family History.*—Mother had never been considered strong; subject to colds of a protracted character.

*Symptoms.*—(a) Pain. Present condition began one year ago with an attack of pain of a severe, boring character, located in the upper left quadrant of abdomen. At that time he passed large quantities of foul-smelling urine which was very cloudy and contained a thick, tenacious material. This attack cleared up under treatment.

Present attack began last August and resembled the previous one. It seemed to follow an ordinary cold. The principal evidence was seen in the cloudy, thickened condition of the urine.

In December last pain reappeared in the left side and abdomen.

(b) No hematuria.

(c) Urine freely purulent; great frequency of urination.

*Physical Examination.*—Palpation; large and readily palpable left kidney. No cystoscopy; X-ray shows suspicious shadow, which is indefinite.

*Examination of Urine.*—Large quantity of pus; bacteria; some albumin. No tubercle bacilli.

Exploratory operation determined upon.

*Operation.*—February 9, 1907. The kidney is readily exposed by a lumbar incision and is found to be enormously enlarged; it feels little more than a pus sac or cystic tumor. The ureter is greatly thickened. The kidney and as much of the ureter as possible removed. Recovery uninterrupted. The urine clears up until it becomes perfectly transparent and normal.

*Examination of Specimen.*—Section of the kidney showed simple ulceration and abscess formation. Almost the entire kidney substance outside of the abscess is replaced by inflammatory fibrous tissue through which are areas of round-cell infiltration and exuded leucocytes. A few glomeruli are present, but the tubules of the cortex are completely atrophied. There are no evidences of tuberculosis.

*Remarks.*—Pain directed to kidney. Marked vesical symptoms. Uncertain X-ray result. Question between tuberculosis and stone. Gross appearance of specimen strongly tuberculous, which the pathological examination, however, disproved. (See Fig. 3.)

CASE 5. *Tuberculous Kidney.*—(Figs. 4 and 5.) ———, aged 28.

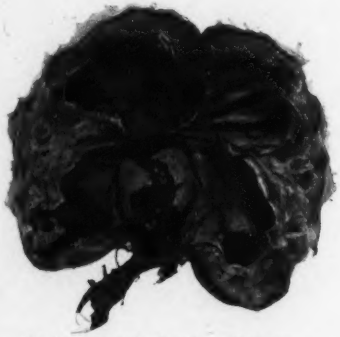
*Symptoms.*—(a) Pain. Severe in character in right kidney, and reflected downward toward the thigh. Irregular in duration.

(b) No hematuria.

(c) Urine purulent.

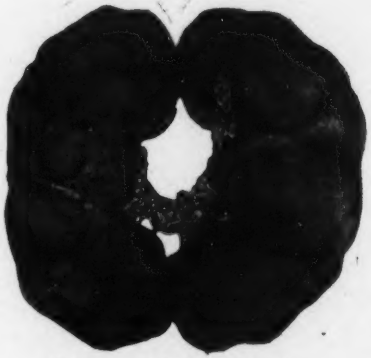
Urination markedly frequent during attacks of pain; less frequent between times. Vesical pain during urination. Condition grew progressively worse while patient was under observation and urination became so frequent that incontinence occurred.

*Family History.*—One aunt died of tuberculosis.

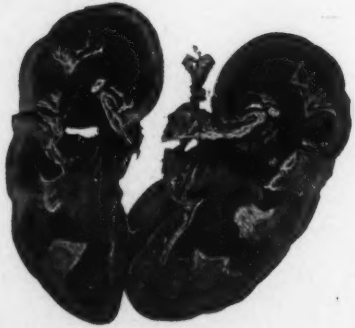


No. 1. Pyonephritic Stone Kidney

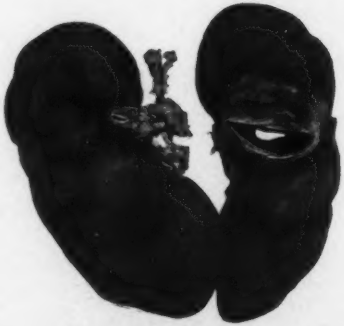
No. 2. Pyonephritic Stone Kidney



No. 3. Outer Surface of No. 2



No. 4. Tuberculous Pyelonephritis



No. 5. Outer Surface of No. 4

No. 6. Tuberculous Kidney

PLATE XV.—Presented by Dr. Charles H. Chetwood

*By permission from the American Journal of Obstetrics and Diseases of Women and Children*

*Physical Examination.*—Palpation; right kidney not palpable, left kidney negative. Right ureter thickened and enlarged.

*Cystoscopy.*—Bladder capacity four ounces. Urinary jet from right side purulent. An ulcerated area is seen surrounding the right ureteral orifice and another in the upper quadrant of the bladder.

*Urinary Examination.*—No tubercle bacilli found.

Operation rejected at first, but conditions grew gradually worse, complicated by febrile attack.

*Operation.*—Kidney exposed through a longitudinal lumbar incision. An abscess was found in the anterior surface of the kidney and several cheesy areas near the cortex. Ureter much thickened. The kidney was obviously tuberculous.

The patient was turned to the opposite side and a small, longitudinal incision made along the opposite kidney, which was palpated with the finger and found to be, as near as could be judged, normal in contour and size.

The affected kidney was then removed with a portion of the ureter. Patient left the hospital in five weeks.

Report of urine from remaining kidney after operation.

Quantity in twenty-four hours, 1,440 cubic centimeters; urea, 28.16 grams; albumin, a trace; some pus in the urine; very few cells; no tubercle bacilli.

Examination of specimen shows an abscess in the anterior surface. Pelvis markedly dilated. Microscopically, shows groups of tubercles with cheesy centers extending into the cortex.

Diagnosis of tuberculous nephritis and suppuration involving the ureters and pelvis of the kidney (pyelonephritis) was made.

Two years following operation patient was seen and found to be much improved in general health, having gained in weight twenty pounds.

*Remarks.*—Predominant vesical symptoms. The presence of tubercles in the urine not established before operation, but general appearance of kidney justified diagnosis of tubercle. The presence of the other kidney being established, the extensive involvement of the right kidney, with pyogenic infection, called for its radical removal. (See Fig. 5.)

CASE 6. *Tuberculous Kidney.*—(Fig. 6.) ———, aged 26; January 13, 1906.

*Family History.*—Negative.

*Symptoms.*—(a) Pain. Present complaint commenced last April with sudden, sharp and severe pain in the upper quadrant of right abdomen and right lumbar region extending downward to the symphysis pubis. This pain lasted for variable intervals and has come on every few days. There has also been pain of a burning character during and after urination; the urination has been increased in frequency and the quantity of urine has been greater during the paroxysms.

*Abstract of Symptoms.*—Sharp paroxysm of pain in lumbar and abdominal regions; burning and frequent urination.

(b) No hematuria. Pyuria.

*Physical Examination.*—Right kidney is palpably enlarged and tender; right ureter thickened. Left kidney cannot be felt by palpation.

*Cystoscopy.*—Bladder wall thickened, but no areas of ulceration. Left ureter is seen acting freely.

An unsuccessful attempt is made to catheterize the ureters. The right ureteral mouth is so contracted that a catheter cannot be introduced.

*Examination of Urine before Operation.*—Urine pale amber, cloudy, no odor, acid; albumin, marked trace; specific gravity, 1,015; many pus cells; cubical epithelial cells; tubercle bacilli found.

As the indications pointed toward an active surgical lesion in the right kidney and as cystoscopy had demonstrated an active functionating kidney on the left side, ureteral catheterism having been unsuccessful, exploratory operation determined upon May 7, 1906.

The right kidney is exposed through an incision in the right lumbar region and the kidney is found to be markedly enlarged and extensively diseased. There were many cheesy areas and large foci of necrotic tissue. In the lower pole there is evidence of advanced disease. (See Fig. 6.) Kidney removed. Wound heals slowly; but patient sustains operation fairly well. Patient discharged from hospital May 19, 1906, improved in general condition.

*Remarks.*—It is evident that the remaining kidney is also diseased, but, on account of the removal of the most active focus

in the left kidney, it is hoped that the ultimate result will show itself in improvement in the remaining kidney.

CASE 7. *Rupture of the Kidney.*—(Fig. 7.) ———, aged 45.

Patient was struck by wheel of large baggage truck in the right side, between pelvis and ribs. Contusion of right side. A large, rounded mass palpable in kidney region. Severe pain and tenderness.

*Symptoms.*—Urine contains bright red blood. Five days after injury urine continues to show abundance of blood and some leucocytes, and enlargement over kidney is much more marked; general condition has gradually failed.

*Operation.*—Incision over right lumbar region. An enlargement is exposed the size of a child's head which, when opened, is found to contain the kidney and free blood clots. Complete rupture of the kidney is found; the hemorrhage continues with profuse flow, on which account it is necessary to clamp the vessels, and kidney is removed.

Patient makes a rapid and uninterrupted recovery.

Examination of urine after operation shows that the remaining kidney secretes satisfactorily.

Examination of specimen shows complete rupture of the kidney almost into halves, and a number of areas of suppuration. (See Fig. 7.)

CASE 8. *Rupture of Kidney.*—(Fig. 8.) ———, aged 25.

Accident; patient was struck by a falling wall on the right side.

*Symptoms.*—Contusions of right side. Great tenderness over right kidney, front and back. Greater rigidity of right abdomen. A large mass is palpable in the right kidney region.

Bright red blood in the urine.

Urine, three days after admission, shows blood, numerous hyalin, epithelial, and granular casts. Leucocyte count, 15,000.

*Operation.*—Exploratory nephrotomy. Large quantity of blood-clot is found surrounding the kidney. Organ is ruptured through the pelvis. There are a number of areas showing secondary changes suggestive of beginning suppuration. Kidney removed.

Patient left the hospital four weeks after operation.

Examination of specimen shows zigzag tear running into the pelvis almost reaching the outer border. In the cortex are secondary changes, necrotic in nature. (See Fig. 8.)

Microscopical examination by Dr. Sondern yields the following report: Albuminous degeneration of the lining of Bowman's capsules. Proliferation and degeneration of epithelium in the cortical tubules. Diffuse infiltration between the capsules; large areas have lost their staining power and have been converted into necrotic masses. Connective tissue between tubules edematous and diffusely infiltrated with pus cells.

Diagnosis: Acute diffuse suppurative nephritis.

*Remarks.*—Nephrectomy was done in Case 7 on account of extensive laceration and continued hemorrhage, and in Case 8 on account of evidence of beginning suppuration and general physical deterioration.

CASE 9. *Trauma of Kidney; Secondary Nephrectomy.*—Boy, aged 13. Patient sustained injury from falling downstairs. Was thought to have general peritonitis, and a laparotomy was performed three days after injury. Four weeks later a large swelling appeared in the lumbo-abdominal region, which was punctured and emptied. Somewhat later, the swelling having returned, a lumbar incision was made to drain what was a hydronephritic sac. This all occurred previous to the time the patient was seen by the writer, which was about three months after the injury, when the wounds had healed with the exception of a large urinary fistula over the site of the right kidney. In spite of the large amount of drainage of urine through this fistula there was a normal amount of secretion from the bladder.

*Operation.*—Kidney exposed through lumbar incision with difficulty on account of adhesions. The ureter is completely occluded in a mass of scar tissue at the site of the rupture which had extended into the pelvis. Kidney is removed and the boy makes a good recovery. (See Fig. 15.)

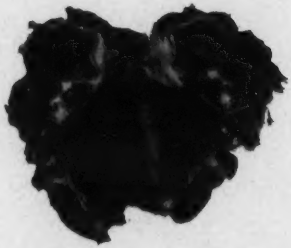
*Remarks.*—The competency of the remaining kidney was established at the time of operation by the quantity of normal urine obtained from the bladder and the fact that the ureter on the injured side was completely occluded.

CASE 10. *Pyonephrotic Kidney.*—(Fig. 9.) Haughton, aged 20; April 19, 1907.

PLATE XVI.—Presented by Dr. Charles H. Chetwood

No. 7. Traumatic Rupture of Kidney

No. 8. Traumatic Rupture of Kidney



No. 9. Pyonephritic Kidney

No. 10. Parenchymatous Nephritis (surgical)

No. 11. Right Pyelonephritic Kidney Acute and Chronic

No. 12. Left Chronic Pyelonephritic Kidney

*By permission from the American Journal of Obstetrics and Diseases of Women and Children*

*Family History.*—Mother died of tuberculosis; no further history of tuberculosis.

*Symptoms.*—Pain. Severe, sharp, dragging pain in right lumbar region; not reflected; almost continuous in character; worse in the upright position; duration, about two months.

*Hematuria.*—No history of such.

*Pyuria.*—Urine freely purulent; heavily laden with free pus and purulent clumps.

*Urination.*—No frequency of urination past or present; no pain connected with urination excepting that associated with the passage of large plugs of purulent material.

*Previous History.*—No venereal disease; no injury. About eighteen months ago was attacked with a sudden illness consisting of chills and fever and general malaise. At that time this malady was called "kidney trouble;" another similar attack six months subsequently.

*Diagnosis.*—Palpation. A large and readily palpable, freely movable mass in the right lumbo-abdominal region, sensitive to pressure. Left kidney region negative.

*Cystoscopy.*—The bladder is cleansed with great difficulty; after fifteen or twenty minutes' washing the return is still hazy. Observation cystoscope introduced; right ureteral mouth dilated; a heavily clouded urinary jet is recognized. Satisfactory observation of the opposite side is not accomplished.

*X-ray.*—Negative.

Urine is turbid; contains heavy sediment; about one-third volume of pus; specific gravity, 1,017; acid; large percentage of albumin. In a microscopic examination nothing is noted beyond the presence of pus. Frequent examination for tubercle negative.

*Blood Examination.*—Leucocytes, 12,000; polynuclears, 62 per cent.

*Operation.*—Lumbar nephrectomy, April 25. Three days after operation urine still purulent, but bulk of pus markedly diminished.

Examination of specimen reveals no tubercle.

*Remarks.*—Causative factor not demonstrated; the potency of opposite kidney not established prior to operation; but the condition of the affected kidney—which was nothing more than a pus

sac (Fig. 9)—justified its removal and reliance upon the other organ.

CASE 11. *Parenchymatous Nephritis; Suspected Tuberculous Kidney.*—(Fig. 10.) L. M., aged 19.

*Family History.*—Father, mother, and one sister died of tuberculosis. One living sister reported to have pulmonary tuberculosis and patient herself had history of hemoptysis.

*Symptoms.*—(a) Pain. Sharp pain in left side much aggravated by walking and movements of body; duration, eight years.

(b) No hematuria.

(c) Urine practically normal in appearance and contains only a small percentage of albumin and here and there a hyalin cast.

*Physical Examination.*—Both kidneys are palpable. Left kidney is acutely tender to pressure.

Report of Dr. Barringer:

*Cystoscopic Examination.*—Bladder capacity, 175 cubic centimeters. Bladder washed clear on first washing excepting for a few flakes. Entire bladder mucous membrane normal. Right ureteral orifice normal, contracting regularly. Left ureteral orifice normal, contracting regularly.

*Separation.*—Separator remained in place 20 minutes. In that time 6 cubic centimeters, of clear urine flowed from the right tube and ½ cubic centimeter of clear urine flowed from the left.

*Analysis:*

| *Right Urine* | *Left Urine* |
|---|---|
| Color, yellow. | Light yellow. |
| Appearance, clear. | Clear. |
| Urea, .007 gm. to 1 cc. | (Not q.s. urea present.) |
| *Microscopical* | |
| Red blood cells, none. | None. |
| White blood cells, rare leucocyte. No pus. | Rare leucocyte; no pus. |
| Epithelium, rare squamous. | Rare squamous. |
| Casts. Two hyalin. | None. |

*Remarks.*—The right kidney seems to be doing practically normal work according to the quantity secreted, although the amount of urea secreted seems to be a little low.

The left kidney seems to be doing but very little work.

PLATE XVII.—Presented by Dr. Charles H. Chetwood.

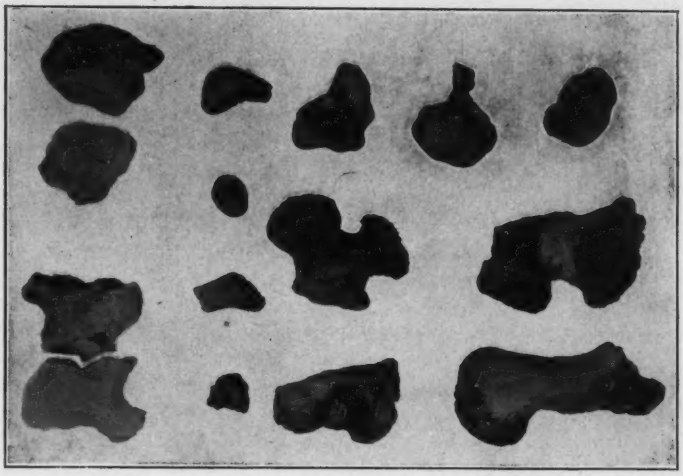


FIG. 13.

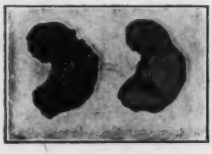


FIG. 14.

FIG. 15.

*Catheterization of the Ureters, April* 9, 1907.—Both ureters were easily catheterized; the right ureter excreting 2½ cubic centimeters in 10 minutes (5 cubic centimeters in 20 minutes), and the left ureter excreting ½ cubic centimeter in 20 minutes.

*Analysis:*

| *Right Urine* | *Left Urine* |
|---|---|
| Color, yellow. | Light yellow. |
| Appearance, clear. | Clear. |
| Urea, .008 gm. to 1 cc. | Not q.s. |
| *Microscopical* | |
| Red blood cells, rare. | None. |
| White blood cells, none. | None. |
| Epithelium, rare squamous. | Rare squamous. |
| Casts, none. | Rare hyalin. |
| Mucus, present. | None. |

*Remarks.*—The separated and catheterized specimens entirely agree.

*Operation.*—Kidney exposed. Ureter catheterized from above downward. General appearance anemic with several areas of density throughout the organ. Kidney removed.

Post-operative examination of urine reveals that remaining kidney is functionating and compensating satisfactorily. The urine is to all intents and purposes normal; there being present only a few pus cells evidently from the operative field.

*Pathological Examination of Specimen by Dr. Sondern.*—The kidney is normal in shape and size. There is subscapsular congestion and slight hemorrhage. Section shows the cortex normal in thickness, but pale. The pelvis shows submucous hemorrhages. Microscopically, the connective tissue elements are found normal in amount. There is slight congestion in places. The parenchyma shows cloudy swelling and extensive sloughing. The tubules are filled with the debris of disintegrating cells. Some of the glomerular cavities also contain debris. Section through the calices of the pelvis shows the epithelium intact. Just beneath it there is an extensive hemorrhage extending with interruptions almost around the lumen. No tubercles found.

*Diagnosis.*—Parenchymatous nephritis. Hemorrhagic pyelitis.

*Remarks.*—The fact that nephrotomy was performed in this

case without conclusive evidence of tuberculosis might call for criticism. Besides the overwhelming family history of tuberculosis, the existence of a pain of long duration located in and identified with the kidney, the very deficient functionating power of this kidney, and several areas of hardness found upon operation, and the history of hemoptysis led to the conclusion that, if these areas were not tuberculous, the chances of their undergoing such changes in the future were so great that the benefit of the doubt was given the patient by the removal of the kidney.

CASE 12. *Double Pyelonephritis.*—(Figs. 11 and 12.) W. G. H., aged 65. April 3, 1907.

*Symptoms.*—Active symptoms directed to bladder and prostate. Marked urgency, frequency, and difficulty of urination; much pain; almost complete retention. Catheter goes with difficulty, and causes great distress. Three days after first examination severe pain in right kidney, spontaneous in occurrence; no hematuria; urine freely purulent and foul.

*Diagnosis.*—(a) Palpation. Neither kidney is palpable.

(Patient put into hospital and perineal drainage performed.)

(b) *Cystoscopy.*—(Perineal.) The right urinary jet is freely purulent and the ureter dilated and congested. Left ureter dilated and congested; urinary jet not noted.

(c) No X-ray.

*Operation.*—On account of progressive diminution and almost complete anuria—the urine secreted being almost solid with pus and reduced to six drachms in as many hours—operation upon the right kidney is determined upon.

The kidney is incised and found to be the seat of acute infection; the pelvis is full of foul, purulent urine.

Because of the uncertainty as to the capacity of the opposite kidney, the kidney is not removed, but sewn in wound. Patient died seven hours after operation.

*Pathological Examination of Opposite Kidney.* (Fig. 12.) Section of the left kidney through the cortex, extending from the margin of one of the ulcerating areas into the fatty capsule, shows the following condition:

The tubules show almost complete atrophy, only a few scattering ones remaining, which have a flat or very low cuboidal epithelium. Many of them contain casts and a few necrotic de-

bris. The walls of the blood vessels are very much thickened. The glomeruli are completely atrophied and replaced by hyalin fibrous tissue. The main tissue present is a fibrous inflammatory tissue which is very cellular. There are young blood vessels developed throughout, giving the appearance of granulation tissue. There are many phagocytes present holding light-yellow, granular pigment. The capsule is thickened and very adherent to the cortex and also to its fatty capsule by inflammatory fibrous tissue.

*Remarks.*—An examination of the history of this case seems to justify the operative procedure throughout. The patient came with complete retention of urine and sepsis, but no symptoms directed to the kidney; and, therefore, there was no choice of operation, the indication being for immediate perineal drainage. Perineal cystoscopy revealed the implication of the right kidney and the probable involvement of the opposite side. The progressive anuria called for immediate operation, and the abscess of the right kidney justified this course. This kidney was so acutely and diffusely infected that its removal, under ordinary circumstances, would have been desirable; but the involvement of the opposite kidney made such a course improper; and therefore nephrotomy alone was performd. The post-mortem examination of the opposite (left) kidney demonstrated the wisdom of such a course, and, furthermore, revealed that a double nephrotomy would not have changed the outcome, as the left kidney was little more than a fibrous mass encapsulated within a fatty sac. (Fig. 12.)

# UPON CERTAIN ASPECTS OF CALCULOUS ANURIA WITH SPECIAL REFERENCE TO CASES OF BILATERAL RENAL CALCULUS AND THE SUGGESTION THAT BILATERAL NEPHROLITHOTOMY OR NEPHROSTOMY BE PERFORMED SIMULTANEOUSLY IN SOME CASES

By Francis S. Watson, M. D., of Boston

IF in a case of calculous anuria, nephrotomy or nephrolithotomy should be done, and if it were then found that the kidney from which the stone is removed was wholly destroyed, we should agree that all that had been accomplished by the operation, would be to have added more or less shock to the already critical condition of the patient, and that the only hope of saving his life would lie in at once cutting into the other kidney.

In other words, whenever the first kidney is found to be destroyed, it is obvious that whatever renal functional activity exists, must reside in the other kidney, and it must be liberated if the patient is to live.

Now, if instead of being wholly destroyed, the first kidney cut into is found to be in greater or less degree extensively diseased, and correspondingly to a greater or less degree functionally incapable, the logical inference is that the kidney of the other side will probably be more or less extensively diseased, and functionally more or less capable in inverse degree to the extent of injury found in the first one; or differently expressed—the worse the condition of the first kidney, the better will be that of the other one, and vice versa.

It is, as we all know, impossible to determine from the thickness or thinness of the layer of renal substance that such kidneys are seen to possess at the time of operation, just what amount of functional activity may be left to them; but we can give a pretty good guess at it, and if in the operator's judgment, it is very doubtful if the first kidney opened has enough sound secreting substance to enable it alone to sustain life, the surgeon should, in the writer's belief, at once operate upon the other kidney. In so doing he may,

it is true, fail to save the life of the patient, but he will have given him the best chance of it, by having put in commission again all the available functionally active renal substance that he possesses, and the patient with calculous anuria needs all that can be secured for him if he is to be given the best chance of living.

If, on the contrary, the first kidney has a good amount of renal substance which is apparently free from disease, the indication *not* to operate upon the second kidney would be equally clear, since the better the condition of the first one, the less likely will it be that there is any functional value in the second one; and correspondingly the less the advantage to be gained from operating upon it.

The above propositions appear to be simple and logical, and so obviously true, that it would scarcely seem worth while to present them were it not for the fact, so far as the writer can learn, that he is the only surgeon who has acted upon them.

The question which at once arises when considering these propositions is: How often, if at all, are the conditions just stated likely to be encountered? That is to say, how often shall we find the first kidney operated upon, so far destroyed or diseased as to make it desirable to operate upon the second one, and how often under those circumstances shall we find enough secreting substance in the latter to justify our doing so?

The cases in which the assumed conditions are likely to occur are: (1) Those of bilateral renal calculus with anuria; (2) those which are unilateral, with anuria, in which both kidneys are more or less diseased, but in which each of them retains sufficient functionally capable substance to be useful if its function were re-established; and (3) those in which the surgeon has selected by mistake for the first kidney to operate upon, the one which is the most damaged.

The occurrence of one or the other of these three conditions is not common, but they do occur. In cases of bilateral calculus, for example, we can never be confident which of the two kidneys may be the least incapacitated, unless we have the aid of an expert in the X-ray photography of renal calculi, or unless the functional capability of each of the kidneys has been established before the advent of anuria by means of the ureteral catheter,

or unless we are fortunate enough to detect at the time of the anuria, by means of the ureteral catheter, the presence of calculus in both ureters.

In practice we shall frequently be deprived of the aid of any of these procedures, for the condition is one of the most serious of surgical emergencies and, when the surgeon is called in, no time can be lost in making such examinations, even if an expert in X-ray photography should be available, which is frequently not the case; and the cases in which the ureteral catheter will render valuable service are also few.

In most instances we shall have to depend on the physical examination and the history of the case alone, and the chances of being misled, more particularly in cases of bilateral calculus, are considerable, because of the absence of characteristic evidence which, were it present, would enable us to determine whether calculus exists on one or both sides, and if on both, which of the two kidneys has received the least damage.

In the unilateral cases also there will always be a certain number in which the operator must be in doubt whether the first kidney operated upon will alone be capable of sustaining life after having been freed of its obstruction. The ones in which the greatest uncertainty is likely to arise are the non-infected hydronephroses which have but a small amount of good secreting substance left in them, for we are all familiar with the fact of how long such apparently inadequate amounts of renal substance are nevertheless capable of doing enough work to keep patients alive and in reasonably good condition. With the infected renal retentions of calculus origin, the operator will feel less doubt as to the functional incapability of the organ, for a well-marked infection will render unfit for service what appears to the eye to be a considerable amount of renal substance, while on the other hand what seems to be an entirely inadequate quantity will, if not infected, be capable of sustaining life sometimes. In the infected cases, therefore, there should be less hesitation in cutting into the second kidney at once whenever serious doubt is in the mind of the operator, than in the non-infected ones.

A study of the cases of unilateral renal calculus with anuria shows that in the larger number of them the organ of the opposite side is either absent or totally destroyed functionally; in the

minority—but an imporant minority—there is more or less disease or destruction of the secreting substance of the unobstructed kidney, but that enough of it is left intact to contribute importantly to the sum total of renal activity, if its function were re-established.

In a few instances the unobstructed kidney has been normal. There are at least four such cases authentically reported. The reflex suppression of a normal kidney has been denied by a number of observers and affirmed by others.

That the sudden obstruction of the ureter of one kidney produces total suppression of the function of its fellow organ, when the latter is more or less injured or diseased, is an unquestioned fact, and so too is it that this happens when the extent of the disease in that kidney is but moderate, or even but very little. That this should not happen more often in cases of calculus anuria is rather surprising when it is remembered that the same thing takes place in the remaining kidney after nephrectomy, if that kidney is more or less diseased, and that urinary suppression occurs as the result of operations upon other parts of the urinary tract or elsewhere in the body, even in some cases when the operations have been trivial in character.

Just what the number of cases may be in which the condition of the first kidney operated upon will be found to be so diseased as to make it proper to lay open the second one on the chance of freeing an additional amount of functionally active renal substance sufficient to contribute importantly to the chance of saving the patient, it is impossible to say. The point which the writer wishes to establish is merely that the degree of probability of being able to do this by cutting into the second kidney should be judged largely by the amount and condition of the renal tissue found in the first one laid open, and whenever it is seen to be but very small in amount, or if it is seriously infected and suppurating even though it be somewhat more in actual quantity, that the surgeon should then give the patient whatever chance of benefit may be derived from cutting into the second kidney at once, unless, of course, previous examinations with the ureteral catheter have already demonstrated the absence or total destruction of the kidney on the other side.

In conclusion the writer would also urge the performance

of bilateral nephrostomy at one sitting in cases of bilateral renal calculus without anuria, as well as in those with it, except the patient's condition be such as to make the longer time required for opening the two kidneys an obviously improper danger to which to submit him.

This procedure has been done by himself only, so far as he is aware. (The case is one of those described at the end of the communication. The patient made an uneventful recovery.) In Wagner's contribution to the *Handbuch der Urologie* of Frisch and Zuckerkandl, that writer says that the calculus should be removed from the second kidney always, then, underlining the words, he adds, *but never at one sitting*.

On what principle this advice is given, and why this custom has invariably been followed with the one exception mentioned, the writer is at a loss to understand. It is not based upon actual experience of bad results obtained from having done the operations simultaneouly upon the two kidneys, since the writer's case which has not been published is the only one, and as has been said, the patient made an uneventful recovery.

The only objection to the procedure that could reasonably be made is that the shock might be too great if both the kidneys should be operated upon in one sitting; nor is it borne out by such experiences as we have of the bilateral, simultaneously performed renal operations that have been done in certain other conditions, such as nephropexy, and decapsulation (sometimes with nephrotomy added to it).

On the other hand, there is every reason *for removing* the calculi from both kidneys at the same time, for why should suppuration $\frac{1}{n}$ even in cases in which there is but an insignificant amount of functionally capable renal substance present in one or another of the organs $\frac{1}{n}$ be allowed to be perpetuated by the presence of a calculus on the one hand; and on the other, why should either kidney, if functionally capable substance *is* present in it, be subjected to the destructive influence of a calculus any longer than need be? For which reasons the stones, unless of insignificant size in one of the kidneys, should be removed at the same time from both organs in cases of bilateral calculus, unless it is clear that the patient cannot endure the longer operation necessary for the purpose.

Appended is the report of some cases which have direct bearing upon the subject of this communication, and also a table of cases of bilateral calculus in which operations were performed —with two exceptions—upon the two kidneys at different times with an interval between the operations.

CASE 1. A multipara aged about 35 years. She had been under the writer's care three years previous. She had never at that time passed any calculi nor had renal pain. Hematuria and pyuria had been present for about three weeks before her entrance to the hospital, and were accompanied by marked vesical tenesmus and frequent micturition. There was also at this time a good deal of phosphatic sand in the urine. The general condition was good and there was little or no fever.

The urine contained a nearly normal quantity of solids, the sediment was large. It consisted of pus, a moderate quantity of blood, a good deal of thick stringy mucus, a great quantity of detritus of vescial epithelium, a large amount of crystals of the triple phosphates and phosphatic sand. The urine was ammoniacal. No tenderness or enlargement of either kidney. Appetite good, no constitutional disturbance.

Cystoscope showed what was believed to be a partly necrotic papilloma of the bladder with long villi floating far out from the vesical wall.

The hematuria became much less after the patient had been in bed for a few days.

*Operation.*—Suprapubic cystotomy. A large mass was found occupying the interior of the bladder and attached to the lateral wall a little external to the orifice of the right ureter by a pedicle about as thick as the thumb, solid and fleshy.

The pedicle of the supposed tumor was divided with the writer's galvano cautery scissors, a margin of the surrounding tissue being included in so doing, and the mass was removed. On examination it proved to be the entire inner lining of the bladder which had undergone necrosis and had involved a part of the muscular structure of the organ, so that it was partly detached from the surrounding tissue and gave the impression of the pedicle of a new growth.

The bladder was drained and the incision healed slowly by granulation. The recovery was uneventful.

The patient remained well until about six months before her second entrance to the hospital. She then for the first time began to have more or less pain in both kidneys, and hematuria reappeared. She also had oliguria occasionally.

For three days before entering the hospital very little urine was passed, and for the last twenty-four hours there was complete anuria. Uræmic symptoms began to be manifested on the day before her admission, and were progressive.

Temperature 102 to 103° F. Pulse rapid. Tongue coated. Bowels constipated. Occasional vomiting. Intellect clouded. Moderate distention of abdomen and slight spasm of the muscles of the right side. Some tenderness in both flanks. Twitching of muscles of hands and forearms. General condition critical.

*Operation.*—Third day of anuria, thirty-six hours after beginning of uræmia. The patient was placed upon the abdomen across the inclined planes made by the Cunningham "kidney operating table." The right kidney was first exposed in the loin. It was found to be buried in a mass of connective tissue, and was universally adherent. In separating it from this mass at the upper part of the organ, a large perinephritic abscess, communicating with the interior of the pyonephrotic kidney, was opened. In the pus which escaped were several fragments of phosphatic stone. The kidney was laid open parallel with, and a little posterior to its convex border. It was pyonephrotic and its secreting substance extensively destroyed, enough of it, however, remained intact, it was thought, to be in some measure functionally capable. A perforation near the upper pole communicated with the perinephritic abscess. A large calculus lay in the pelvis and sent branches into the dilated calyces. A part of the calculus only could be removed.

While the writer's colleague, Dr. Blake, cleansed the operative field, sutured the wound in part, and arranged drainage, the writer laid open the second kidney and removed broken bits of calculus from it.

The conditions on this side were identical with those upon the other, with the exception that there was, if anything, a little less secreting substance in the kidney, and that the stone was smaller. The calculi occluded the outlet of the renal pelvis of each kidney.

The wound and drainage were arranged as on the other side. The operations occupied twenty-five minutes altogether.

Both kidneys began to secrete within three hours after the operation, the first one operated upon, abundantly, the second one not so much. On the following morning the patient felt decidedly better and the uræmic symptoms had almost entirely ceased. This improvement was maintained for twenty-four hours, uræmia was then once more noticeable, and she died on the third day.

Shock played no part in causing death. No autopsy.

CASE 2. A man of thirty-five years of age in good general condition who had had more or less characteristic evidence of renal calculus on the right side, and suggestive signs of it on the left as well, for the past year.

X-ray pictures showed a calculus clearly in the right kidney and gave a doubtful shadow in the left one.

*Operation.*—By mistake the first kidney operated upon was the one in which the doubtful shadow of the X-ray photograph had appeared. It was laid open after being exposed by the usual incision in the loin. Exploration of the interior of the kidney failed to discover a calculus. The renal and outer incisions were both closed tight by suture. The other kidney was then laid open and a calculus about the size of a chestnut was removed from one of the calyces. This one was but slightly infected. The calculus had a smooth surface. A drainage tube was placed in the kidney and the renal incision was closed around it. The outer wound was closed except for the space to allow the passage of the tube. Drainage maintained for two days. Wound closed in a short time. The incision on the other side healed per primam. Recovery uneventful.

CASES 3, 4, 5. These were all of them cases of bilateral renal infection with extensive suppuration. The surgical intervention in the first of them was a simultaneously performed bilateral nephrostomy. Drainage of both kidneys. This patient made a good recovery without persistence of fistula.

In the other two cases unilateral nephrotomy only was done. Both patients died. Both had abscess of the other kidney. One of them would probably have lived had the second kidney been opened.

OPERATIONS DONE IN CASES OF BILATERAL CALCULUS

| Operators | Cases | Nature of Operations | Results | Remarks |
|---|---|---|---|---|
| Chevalier | 1 | Unilateral nephrotomy | R | Anuria of 14 days preceded operation |
| Championnier | 1 | Unilateral nephrolithotomy | R | Same for 13 days |
| Deaver, 1900 | 1 | Nephrolithotomy on one kidney. 18 days later nephrectomy on same kidney. 9 months later nephrolithotomy on other kidney | R | |
| Deansley, 1899 | 3 | (1) Nephrolithotomy on one kidney. 2 weeks later same on other kidney | R | |
| | | (2) Unilateral nephrolithot. No operation on other kidney | R | |
| | | (3) The same | R | |
| Desnos | 1 | Unilateral nephrolithot. | R | Anuria 12 days preceding operation. |
| Duret | 1 | Unilateral nephrolithot. | R | Same 10 days |
| Delbet, 1899 | 1 | Unilateral nephrolithot. Second kidney same one year later | R | Hydronephrosis of first — pyonephrosis of second kidney |
| Kummel, 1903 | 16 | 5 with anuria — Unilateral nephrolithotomy. 11 without anuria, same operation with second kidney done after an interval in each case | 3 D<br>2 R<br>9 R<br>4 D | |
| Grohe, 1902 | 1 | Unilateral nephrolith. on one kidney and same on other after 15 days | R | |
| Mixter, 1901 | 1 | Same—second kidney done six months later | R | |
| Tuffier, 1900 | 1 | Same and later, at two intervals, same on second kidney | R | |
| Verdi, 1904 | 1 | Same. Calculus passed. Spontaneously from other | R | |
| Watson, 1905 | 2 | Simultaneous bilateral nephrolithotomy in both | 1 D<br>1 R | Anuria in fatal case |
| Young | 1 | Unilateral nephrolithot. | 1 D | |

Total 32, Deaths 9=27.9 per cent.

# THE EXTENSION OF THE SPHERE OF TREATMENT OF CERTAIN RENAL AND VESICAL DISEASES THAT IS OFFERED BY AN IMPROVED MANNER OF RENAL DRAINAGE IN CASES IN WHICH LONG STANDING OR PERMANENT RENAL LUMBAR FISTULÆ EXIST OR MAY BE DESIRABLE TO HAVE EXIST

By Francis S. Watson, M. D., of Boston

IF life could be made not only tolerable, but comfortable for persons with long standing or permanent renal fistulæ, and the renal drainage could be so arranged as to allow them to pursue occupations of more or less activity, in what respects would this fact modify or enlarge the field of treatment in cases of renal or vesical disease?

It seems to the writer that the following advantages might reasonably be expected to result:

Primarily it would enable us to save kidneys which have renal fistulæ connected with them and which are yet capable of many years of valuable functional service, which we at present, in many instances, sacrifice in order to spare the patients the distress which arises from the fistulæ.

The patients would thus escape the risks attending nephrectomy and such also as may be incurred from the mere fact of having but one kidney.

Next it would enable us to utilize permanent renal fistula in the following way:

By performing bilateral lumbar nephrostomy—operating upon both kidneys at the same time—establishing permanent renal fistula in both loins, and diverting the urinary secretion from the bladder by ligating both ureters, for the following purposes:

I. *As a Palliative Measure* (*a*).—In cases of inoperable vesical tumor. (*b*) In cases of vesical tuberculosis originating in descending infection, in which both kidneys are involved in the tuberculous process and when the tuberculous lesions of the bladder are

causing suffering. In the latter condition also, there might be expected to be better results obtained from the local treatment of the vesical tuberculous lesions.

II. *As a Step Preliminary to the Total Extirpation of the Bladder in Certain Cases of Vesical Tumor.*—This proposal was made by the writer at the Montreal meeting of this Association in 1905 and published in the December number of the *Annals of Surgery* of the same year. It is intended to speak of it here again merely to re-affirm the writer's position with regard to it, which has been strengthened with respect to one of its features by the practical experience of three cases in which he has simultaneously performed bilateral nephrostomy, and which has supported his contention that shock was not an element to be dreaded from the performance of the operation upon the two kidneys at the same time.

The members of the Association will recall that it was as follows:

"That instead of doing ureteral inplantation in connection with partial resections or total extirpations of the bladder in cases of tumor of that organ, that procedure be wholly abandoned, and that simultaneously performed bilateral lumbar nephrostomy be substituted for it, and that it be done as a step preliminary to the removal of the bladder, the latter intervention being carried out at periods of such appropriate length afterward, as may be determined by the conditions existing in each case. That this course be pursued in cases of carcinoma of the bladder in which any radical operation is proper to do at all, and to recurrent tumors following the removal of benign neoplasms, if there is any reason to believe the recurrent growth to be of malignant nature."

The success of these measures must depend in large degree upon the possibility of arranging the drainage from the kidneys after the lumbar nephrostomies, in such manner as to be comfortable, and thus to be secure of avoiding the creation of a condition as intolerable in its way, as that for the relief of which it was undertaken.

This object the writer believes he has attained by a very simple contrivance which he has devised, whereby that feature of renal fistula which is the one which causes it to be such an infirmity is entirely overcome. The greatest trial of renal fistula is having the clothing and dressings constantly soaked with urine, and the

PLATE XVIII.—Presented by Dr. Francis S. Watson.

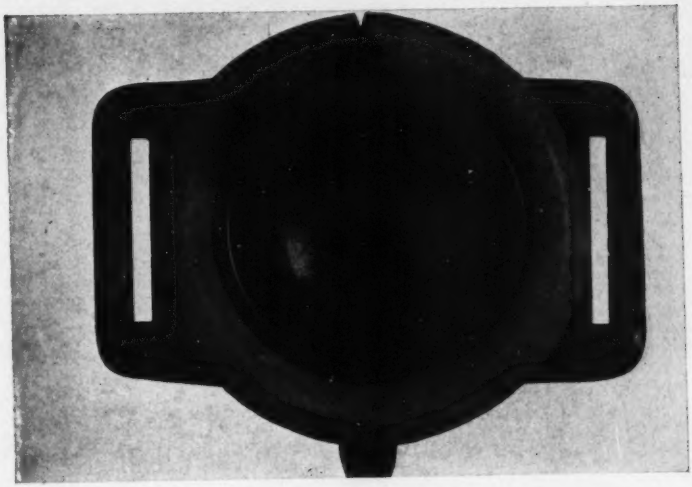


FIG. 1.—Cup-shaped shield of Watson's apparatus for renal drainage.

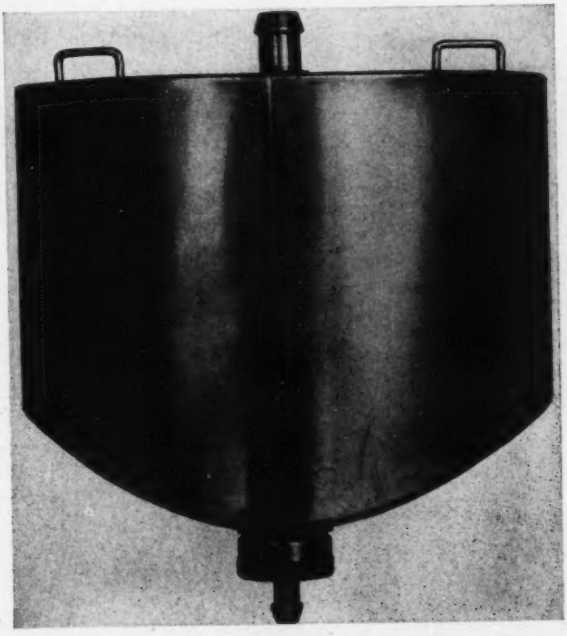


FIG. 2.—The receptacle of Watson's apparatus for renal drainage.

unpleasant odor which emanates from them. The contrivance designed by the writer keeps the patient perfectly dry, and can be worn without attracting attention and with entire comfort. It is made up as follows:

1. A hard rubber cup-shaped shield through which the tube that enters and drains the kidney is passed. (Fig. 1.)

2. A light metal receptacle into which the urine is conveyed. (Fig. 2.)

3. A rubber tube attached to the bottom of the receptacle by means of which the latter is emptied whenever desired. (Fig. 3.)

4. Two elastic bands or belts one inch in width which pass around the body and by which the shield and the receptacle for the urine are held in place. (Fig. 3 and Fig. 4.)

1. *The Shield.*—The shield is made up of a circular, cup-shaped, central part, and two side wings. The former is perforated by two holes (see Fig. 1), one of them passing through its center and having a downward slant in its course through the shield in order to avoid being obliged to give the kidney drainage tube a sharp bend and thus narrow it as it passes down to the receptacle. The second hole is just within the inner margin of the rim of the circular part of the shield and at the lowest point in the circumference when the shield is in place upon the surface of the back. The purpose of the second hole is to drain the cup of the shield, which it does by the smaller of the two tubes which pass to the receptacle. (See Fig. 3.)

The cup of the shield catches whatever urine leaks around the outer sides of the kidney drainage tube, and this leakage is at once passed into the can in the manner already mentioned.

Elastic bands one inch in width are passed through the openings in the wings of the shield and are thus attached to it (see Fig. 4), and being passed around the body and buckled in front, form the belt by which the shield is constantly held close upon the surface of the loin.

The tube draining the kidney directly, and which passes through the hole in the center of the shield, must be one or two sizes larger than the hole, in order that it shall bind firmly against the sides of it, and thus be prevented from changing its position to or fro, and pressing injuriously on the kidney on the one hand, or being withdrawn too far to efficiently drain it on the other.

The tube draining the cup is to be fitted over the end of the smaller of the two metal tubes which are placed in the middle of the upper surface of the receptacle and in this way the junction between the cup of the shield and the receptacle is effected. The main drainage tube from the kidney is passed in the same way over the end of the larger metal tube of the receptacle, or if the drainage tube is too small to allow this to be done, it can be passed *into* the metal tube instead. (See Fig. 3.)

The caliber of the central hole in the shield is about 28 of the Charriere scale. If the kidney drainage tube is in any case so small that it will not bind in the hole, its caliber at that point can be sufficiently increased by passing over it a second bit of tubing just where it traverses the hole.

It is important to adjust the kidney drainage tube at the spot within the kidney at which its end drains the organ most effectively and at the same time causes the patient no discomfort. Once this has been determined, a mark should be made upon the catheter or drain just where it emerges from the outer side of the shield, in order that time shall not be wasted in readjusting the tube each time it is introduced.

The tubes and all parts of the apparatus, except the shield, and the belts should be detached and boiled in a strong solution of rock salt and water and the shield and can should be thoroughly cleansed, as well, once each day.

2. *The Receptacle* (see Fig. 2).—The receptacle is a can made of German silver, curved to fit the upper part of the gluteal region and provided with the following things: Upon the middle of its upper end are two short metal tubes (see Fig. 3) upon the larger of which the main kidney drainage tube is attached. The smaller one receives the end of the tube which drains the cup of the shield. Two pieces of bent wire (see Fig. 2) set into the inner edge of the receptacle to which the elastic belt is attached which keeps the can in place. A metal cap (see Fig. 2) in the middle of the bottom of the can which unscrews and allows it to be more readily cleaned.

3. *The Tube for Draining the Receptacle* (see Figs. 3 and 4).—A tube about a foot and a half to two feet long is attached to the screw cap in the bottom of the can and is led round to the front of the body where it is tucked under the belt and its end brought

PLATE XIX.—Presented by Dr. Francis S. Watson.

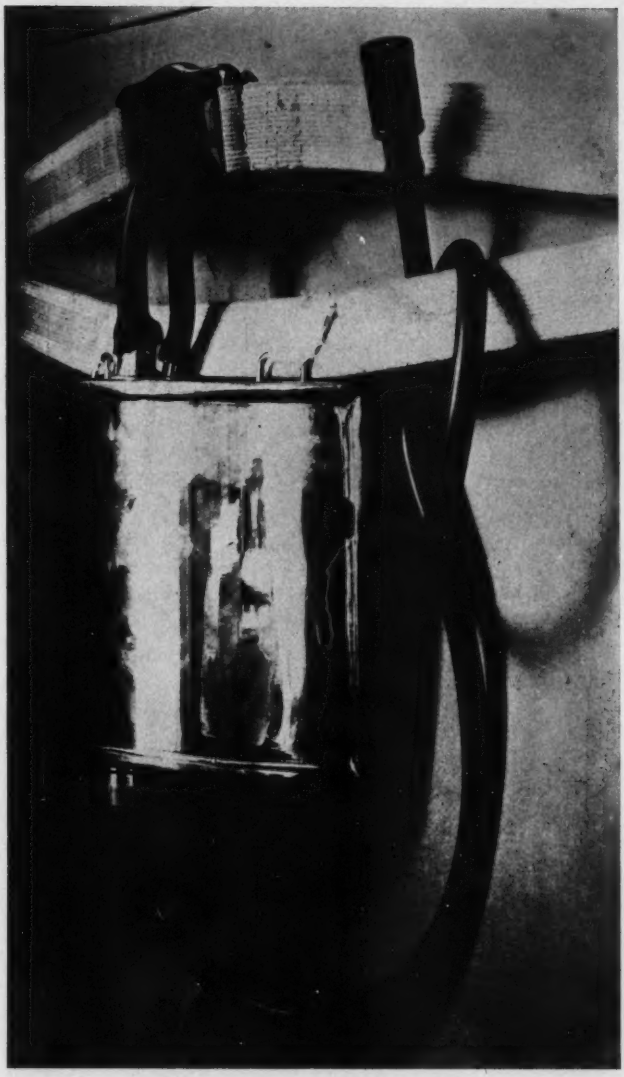


FIG. 3.—Watson's apparatus for drainage of the kidney through the loin, showing the different parts, viz: the receptacle with its evacuating tube attached; the two tubes connecting the shield and receptacle; the belts.

over it and allowed to hang downward. The further end of this tube is provided with a hard rubber cap (see Fig. 3) one end of which has the form of a stem and slips into the soft rubber tube. In this stem is a hole. The hole is closed by the hard rubber cap when it is screwed home against the shoulder which is just behind the hole, while when the cap is screwed outward in the other direction, the hole is uncovered.

The capacity of the can is about ten ounces, and consequently it does not require to be emptied more than two or three times daily. When it is desired to do this, the tube which drains the can is taken from beneath the belt in front, and the hole just described at its end being opened, the can is evacuated of its contents. The hole is then closed and the tube replaced. (See Fig. 4.)

By this contrivance the patient is spared the trouble of detaching any parts of the apparatus from each other during the entire day.

### THE MANNER OF ARRANGING THE DRAINAGE AT NIGHT

At night the can is detached and long tubes are substituted for the ones which drain the shield and the kidney. The two tubes are led to a bottle which is fastened to the side of the bed and the drainage is received by that during the night.

A semi-reclining position ensures better drainage than if the patient lies quite flat.

The receptacle can be attached nearer or further away from the shield or can be carried slightly to one or the other side of it, —corresponding changes being made in the length of the tubes,— as the patient may find to be most convenient and comfortable.

Fig. 3 shows the apparatus in position with the tube which drains the can passing around to be placed under the belt in front. The essentials of the receptacle are that it shall be light, fitted to the surface upon which it lies, its capacity sufficient to avoid the necessity of emptying it too often and of such a character that it can be readily cleaned.

The shield is given a very slight curve in order that it may adapt itself more completely to the surface of the body, and thus insure the cup being tight and not leaking at all.

The object aimed at in this contrivance is to keep the patient

dry; the failure to do this hitherto has been the one greatly distressing feature of renal fistula. It is owing to this feature that individuals with renal fistula which leaks are wholly disabled and practically isolated from their fellows because of the unpleasant odor arising from that source.

I have had this device in use with entire success in two instances. In one of them a little change in the adjustment, and the size of the cup of the shield was required before it worked properly.

The contrivance can be equally applied, of course, to fistulous openings of transplanted ureters and other similar conditions connected with the different organs of the body, with which fistula is connected.

One word with regard to the advantages of nephrostomy as compared to ureteral implantation. The latter is open to a serious objection, which is that it frequently invites renal infection because of contraction of the implanted orifice of the ureter, or of the latter at some point between the orifice and the renal pelvis; and, in case of intestinal implantation, because of its being a septic locality.

The following tables show what the results of ureteral implantation were found to be in 94 cases in which it was done for different conditions.

The operative mortality for the whole series was 41.4%; 23.4% was directly due to ureteral implantation.

The conditions in which the implantations were done are as follows:

| Vesical tumors | Cases | Op. D. | Causes of death | | Later deaths and their causes |
|---|---|---|---|---|---|
| Suprapubic, not resections | 11 | 0 | | | 2. One to ureteral contraction. 1 not stated |
| Partial resect. | 23 | 11 | *Ren. infect.*, | 3 | |
| | | | *Shock*, | 4 | |
| | | | *Infilt. of urine*, | 2 | |
| | | | *Peritonitis*, | 2 | |
| Total extirp. | 38 | 19 | *Ren. infect.*, | 10 | 3. Ren. infect., 2. Recurrence, 1 |
| | | | *Shock*, | 9 | |
| | | | *Pneumonia*, | 1 | |
| Ureter cut in abdom. ops. | 22 | 9 | *Ren. infect.*, | 6 | |
| | 94 | 39 or 41.4%. | Due to ureteral implantation 22, or 23.4% mortality | | |

PLATE XX.—Presented by Dr Francis S. Watson.

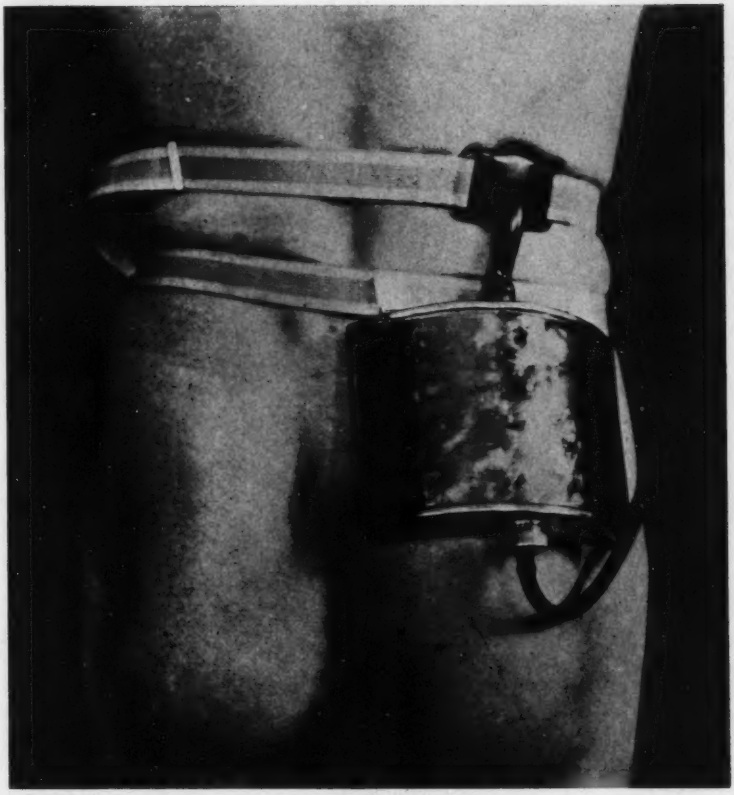


FIG. 4.—Watson's apparatus for renal drainage in the loin, showing it in the position occupied when being worn.

These cases in detail are as follows:

## CASES OF VESICAL TUMOR

### TREATMENT OF THE URETERS WHEN DIVIDED IN OPERATIONS FOR THE REMOVAL OF TUMOR

### I. TOTAL EXTIRPATION OF THE BLADDER—38 CASES

| Treatment of ureters | Op. R. | Op. D | Causes of death | Due to ureteral implantation | Later deaths and causes of |
|---|---|---|---|---|---|
| Abandoned in wound | 2 | 2 | Renal infect., 1<br>Shock, 1 | 1 | |
| Sutured into intestine | 5 | 10 | Renal infect., 5<br>Shock, 4<br>No data, 1 | 5 | 1 at 3½ months, renal infect.<br>1 at 14 months, no data |
| Sutured to skin | 3 | 1 | Renal infect., 1 | 1 | 1 at 13 months, renal infect.<br>1 at 6 months, recurrence |
| Sutured into vagina | 3 | 2 | Renal infect., 1<br>Shock, 1 | 1 | |
| Sutured to urethra | 1 | 4 | Renal infect., 2<br>Shock, 2 | 2 | |
| | 14 | 19 | 19 | 10 | 4 |

Without data, 5. Total number, 38.
Deaths due to ureteral implantation, 10.

### OPERATORS REPORTING THE ABOVE CASES

Bardenheuer, 2; Pawlik, 1; Albarran, 1; Modllinski, 3; Kuster, 1; Wassilief, 1; Bergenhem, 1; Mann, 1; Verhoogen, 1; Vaughan, 1; Woolsey, 1; Viljianinow, 1; Schede, 1; Turetta, 1; Hogge, 1; Krause, 1; Kayser, 1; Lund, 1; Mayo Robson, 1; Gopel, 1; Harris, 1; Tuffier, 1; Lindner, 1; Zeller, 1; Garre, 1; Wendel, 1; McCosh, 2; Giordano, 2; Chalot, 1; Kossinski, 1; Kummel, 1.

II. PARTIAL RESECTIONS—23 CASES

| Treatment of ureters | Op. R. | Op. D. | Causes of death | | Due to ureteral implantation |
|---|---|---|---|---|---|
| Implanted into bladder | 12 | 9 | Shock, | 4 | |
| | | | Renal infect., | 2 | 2 |
| | | | Infiltration of urine, | 2 | 2 |
| | | | Peritonitis | 1 | |
| | | | | 9 | 4 |
| Abandoned in wound | 0 | 2 | Peritonitis, | 1 | |
| | | | Cellulitis, | 1 | 1' |
| | 12 | 11 | | 11 | 5 |

Total, 23. Deaths, 11. 47.8%

Deaths due to ureteral implantation, 5; 45.4% of deaths due to ureteral implantation; implantation into bladder, 21; abandoned in wound, 2.

The surgeons reporting these cases are: Israel, 2; Czerny, 5, Albarran, 2; Bardenheuer, 2; Schuchard, 1; Helferich, 1; Giordano, 1; Schilling, 1; Verhoogen, 1; Rafin, 1; Rehn, 1; Kuster, 1; Mickulicz, 2; Berg, 1; Vincini, 1; total, 23.

## III

### VESICAL TUMOR

#### OPERATIONS OTHER THAN PARTIAL RESECTION OR TOTAL EXTIRPATION

Cases, 11; Deaths, 0. Later, 2.

Implantations into bladder, 11. Later deaths, 2. Due to ureteral implantation in one, perhaps, not so in the other.

In 7 other cases there was an opportunity to test the patency of the ureter at various times subsequent to the operation. In one of these the ureter was apparently obliterated and the kidney was believed to have undergone atrophy. The patient was, however, in good health.

Operators in these cases were: Routier, Pernice, Krug (case observed eight years after operation), Kalabin, Rafin, Wertheim, Frantz (5 cases).

With direct drainage of the kidney through the loin, on the other hand, the objection which has been brought by the writer against ureteral implantation, does not hold good, provided the drainage is thorough and thoroughly maintained, if ordinarily good care be taken of it, and the fistula be prevented from recontracting. There is, moreover, the further advantage that nephros-

tomy and free drainage of the kidney directly through the loin, is by far the best treatment that can be applied to cases of already infected kidneys with suppuration and in many of hydronephrosis, for which ureteral implantation is ineffectual, and in some of them actually invites an increase, sooner or later, of the malady. Furthermore in such conditions ureteral implantation gives no opportunity to explore the interior of the kidney, remove calculi, or break down partitions separating abscess cavities and so on, which nephrotomy does afford. Finally, the mortality attending incision and drainage of the kidney is, *per se*, very small, while the contrary, as has been shown, is true of ureteral implantation.

It will be remembered that in the series of cases given above in which that procedure was carried out, death was caused by it, *per se*, in 23%.

It is difficult to get an exact idea of the mortality of nephrostomy as an operation and the same is true of ureteral implantation, because of the serious conditions under which, or in connection with which, the two procedures respectively are done. The nearest approach that can be made to determining the operative mortality of each is by a comparison of Maydl's operation on the one hand and nephrotomy when due in the cases of non-infected kidneys on the other. Of 42 cases of Maydl's procedure for ectopia 9 ended fatally, or 21.4%. (Three of the deaths, or 7.1%, were directly due to ureteral implantation.) In 143 cases of hydronephrosis there were but 5 deaths following nephrotomy, or 3.4%. In 77 nephrotomies reported by Albarran done for various conditions, there were 3 deaths, or 3.7% mortality.

# MENSURATION IN URINARY DISEASES

By HOWARD A. KELLY, M. D., of Baltimore

EVERY specialty passes of necessity through three phases: (1) Of dawning knowledge, (2) of increasing accuracy of observation with differentiation, and (3) the adoption of methods of registration.

A specialty may be said to have reached its acme when its followers habitually record their observations in such terms that (1) any changes in the course or character of the disease are easily recognized, and (2) other observers are enabled to form an accurate mental picture of the disease and so utilize experiences other than their own. It would be impossible to overestimate the value of this amalgamation of experiences of the many by the individual in furthering the progress of scientific medicine. I think most of those who hear will agree with me that much of our medical literature is often rendered valueless by a colorless description of cases, giving them no marked individuality.

Several factors conspire in our descriptions of morbid processes to make a perfect picture:

1. The pictorial art itself, whether the work of the artist or photographer. It is because this valuable adjunct to our work is so perfect, so literal, and so unbiased a presentment of a case that it has been warmly welcomed and widely used ever since the first crude pictures were employed a little over 400 years ago. I think you will agree with me that we may congratulate ourselves upon an extraordinary improvement in this branch of art within the past decade.

2. I note a growing tendency toward fuller descriptions of cases, albeit there is much yet to be desired in clearness and power of description. This fault is due to the fact that men aspiring to be scientific often hold literary qualities and finish in too little esteem. The scientist who lacks grace and charm and finish in his writing may be compared to a powerful but clumsy athlete, or a man with strong vision but only in one eye.

3. Lastly, we need more instruments of precision in connection with the recording of cases, instruments which exclude vagueness and the element of personal bias as far as possible. We have but few such and they are readily named: The thermometer; the microscope; the hemaglobinometer; the esthesiometer; the various refraction instruments of the ophthalmologist; the electric testing instruments for determining the condition of muscles and nerves; and to these I may add the piezometer to measure resistances and sensitiveness, and, in vaginal work, the calibrator.

It is with a view of extending the field of accurate measurements into the dominion of urology that I desire to speak to-day.

I propose to describe methods of mensuration by which the comparisons between disease and health can be more accurately made, and utilized to the great advantage of the specialist, as I shall briefly show in each case.

It is for several distinct reasons that I wish to urge the application of mensuration in the study and record of diseases of the urinary organs.

1. *For Reasons which Benefit the Examiner.*—The time and care given to the work develop greater accuracy and familiarity with the field, thus proving of immense value to the specialist; in fact such an investigation ought to make the difference between him and the tyro.

2. *For Reasons of Diagnosis and Treatment.*—(*a*) A different picture of the disease is obtained, for it is thus recognized as a part of a process advancing from a mild to a more serious stage; the individual examination becomes, as it were, one view in a kaleidoscopic series. (*b*) This familiarity with every stage of the disease makes possible its recognition in very early stages, where otherwise it would be overlooked and left to advance. (*c*) The accurate differentiation of stages of a disease makes possible the application of various methods of treatment suitable to each stage, and at the beginning simpler methods are applicable.

3. *The Benefit which Accrues to the Record and the Consequent Transference of One Observer's Findings to Another.*—In a given case where measurements have been used throughout, one

can estimate the progress of the case toward cure, or at any moment determine just what has been accomplished and also state definitely when cure is effected.

The methods of mensuration which are applied to the urethra, the bladder, the ureters, and the kidneys, are: Linear, angular, volumetric, and tensometric measurements (excuse the hybrid word). By means of these the capacity of the bladder is determined, whether contracted, expanded, or normal.

The location and extent of vesical lesions are measured accurately:

Vesical, diversicula, scars, and trabeculæ.

The distances of the ureteral orifices from the internal urethral orifice.

The angular direction of the ureteral orifices from the axis of the urethra.

The exact length of each ureter.

The tightness of a urethral or a ureteral stricture, as well as its caliber.

The location of a stricture in a ureter.

The location of a stone in a ureter.

The exact capacity of a renal pelvis with its calices.

The normal of the bladder distended with air in the knee-breast position has been determined in from 11 to 23 cases in the following manner: A graduated urethral speculum, such as is here shown, 14 cm. long from the vesical end to the outer rim, is introduced into the bladder, which is then emptied by suction of all its fluid. The bladder is afterward illumined by reflecting a light into its interior with a head-mirror. The speculum is then withdrawn until the internal orifice of the urethra just begins to appear and to close over its end. The length of the urethra is next measured by reading the length of the speculum outside the body, and deducting this from its entire length. In 10 cases, the average urethral length was 4.5 cm., the shortest being 3 cm., the longest 5.5 cm. Luschka gives 3 cm. as the average, and Sappey the same. Keeping the speculum in this same position, a long, metal, centimeter measure is now introduced into the bladder until it touches the posterior wall. The distance the measure has entered is read off at the outer rim of the speculum. When deducting the length of the speculum, we have

PLATE XXI.—Presented by Dr. Howard A. Kelly.

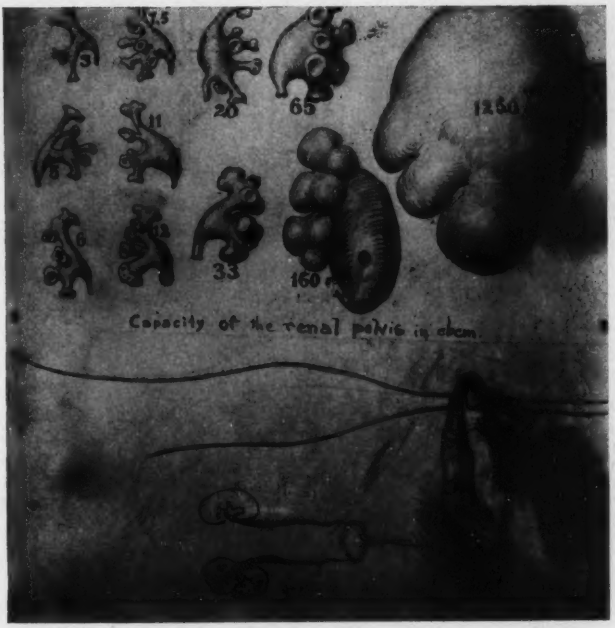



FIG. 1.—Shows above the relative size of renal pelves from 2 to 1250 cc. actually made by plaster cast. The lower part of drawing illustrates the measurement of ureters and the finding of the stricture in the right ureter.

the distance of the internal urethral orifice from the posterior or sacral wall of the bladder, or the extension of the bladder in this direction.

In 23 cases the average distance from the urethra to the posterior wall was 6 cm., the greatest being 8.5 cm., and the smallest, in a normal bladder, 5 cm.

Raising the speculum high up to an angle of about 50° with a horizontal plane, another important measure is taken to determine the distance of the vertex of the bladder from the internal urethral orifice. In 11 cases I found this to be 5.7 cm. On an average the greatest extension in this direction was 7.5 cm., while the smallest was 4.75 cm. These measurements were made in normal bladders.

If the speculum is turned well to the right and then to the left, taking care that its end rests at the internal urethral orifice, the cornua of the bladder are seen. The average distance to the right or to the left cornu is a little over 5 cm. The greatest distance 7 cm.

The distance from the external urethral to the ureteral orifices in 19 cases averaged 7.1 cm., the longest distance being 8 cm. If we deduct from this the length of the urethra, we have an average distance of the ureteral orifices from the internal urethral orifice of 2.5 cm. In comparing the observations of Luschka, Quain, Sappey, and Henle with my own, I find Luschka gives the antero-posterior diameter as 10 cm. in a distended bladder, while Sappey estimates it as 8 cm. If will be seen that these measurements are from 4 to 2 cm. greater than my own. I am inclined to consider my own as more accurate, because in examing the patient in the dorsal position, and distending the bladder with fluid, it is not possible to state just when the bladder is being distended or the degree of distention, while in my own measurements with no fluid, but with air in the bladder, the walls simply drop apart under the influence of atmospheric pressure, and no distending force whatever is exerted. The value of these measurements is seen when we come to investigate the question of contracted bladders. My mensurations of the bladder in the knee-breast posture, particularly when made under an anæsthetic, clearly show that a great many cases labelled contracted bladders by physicians who have had them for months or years under treat-

ment have merely been cases of intolerant bladders, as upon putting them into the knee-breast position, the walls of the bladder have dropped well apart, and the organ has assumed its normal dimensions as determined by the methods given above. I believe a true contracted bladder to be rather rare. I present here, in comparison with these normal measurements, 2 cases of contracted bladder at present in my hands.

### MARKED CONTRACTED BLADDER DUE TO CYSTITIS AND PUS KIDNEY. ILLUSTRATIVE OF SMALL MEASUREMENTS

Miss J. P., aged 58 years.

*Diagnosis.*—Ulcerative cystitis, pyonephrosis, right.

*Operation.*—Right nephrectomy, formation of the vesicovaginal fistula. The family history was markedly tuberculous. Frequency and pain on micturition and loss of weight was complained of. In the spring of 1895, an attack of painful micturition lasting two days. In 1897, a similar attack, pus being found in the urine and in 1903 another attack which persisted and grew worse, for in addition to the frequency of urination there was great tenesmus and pain. Various forms of irrigation of the bladder and a vesicovaginal fistula which she had for six months was equally valueless, but formalin applications gave her some relief. Christian science was attempted for a while without any benefit.

A general examination showed the patient fairly well nourished; no disease of heart or lungs. The urine contained a large amount of pus, colon bacilli, and some blood.

*Special Examination.*—Neither kidney nor ureter were palpable. The bladder was found greatly contracted and covered with ulcers. The measurement to the posterior wall was 2 cm. That to the vertex 2.25 cm.

At the operation, March 12, 1907, a lobulated cystic kidney was removed whose structure had been entirely destroyed. The pelvis and calices were greatly dilated. The ureter was somewhat dilated, but sewn into the lower end of the incision.

On March 28, a vesicovaginal fistula was made. This patient is still under treatment (1907).

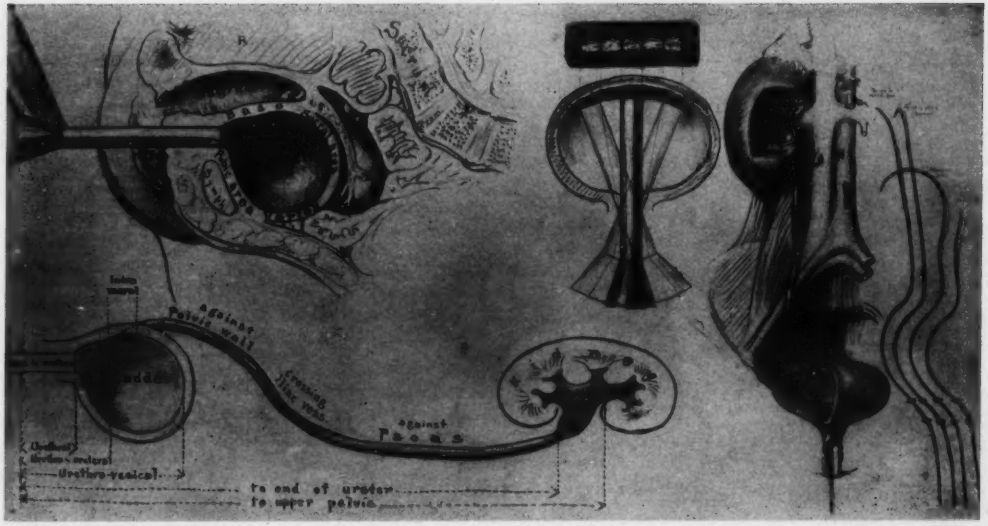



FIG. 2.—To the left and below is a diagram showing the various linear measurements. Just above this is a drawing illustrating the various surfaces of the bladder. In the centre of the picture the figure illustrates the method of measuring a vesical lesion. The figure to the extreme right shows the normal curves of the ureter and some catheters to show marked abnormal bendings.

PLATE XXII.—Presented by Dr. Howard A. Kelly.

CASE ILLUSTRATING CONTRACTED BLADDER MEASUREMENTS AND THOSE OF DIVERTICULUM SHOWING VERY SMALL BLADDER MEASUREMENTS

Miss C. E., aged 40 years; April, 1906. San. No. 2192.

*Diagnosis.*—Tuberculosis of the left kidney, ureter, and bladder.

*Operation.*—Left nephrorectomy.

The family history was negative, and good health had been enjoyed until present trouble. Great bladder distress, frequency of urination, burning, and blood in the urine was complained of; present illness had lasted one and one-half years, beginning with slight increased frequency of micturition which gradually grew worse for six months, with such excruciating pain that she was incapacitated for work as a school teacher. There was never any pain in the kidneys.

General physical examination showed slight evening rise of temperature above normal; hemaglobin, 50%; no evidence of tuberculosis in chest or elsewhere. Patient thin and delicate looking.

*Special Examination.*—Right kidney palpable, the left kidney cannot be felt; right ureter normal; the left thickened and tender. Bladder greatly contracted, its expansion 4 cc., but 50 cc., of fluid injected causes pain. There is superficial ulceration: 20 cc. up left ureter an impassable stricture met; in forty minutes there was no flow from this ureter. The right kidney secreted 18 cc. in twenty minutes, the urine being normal. On removing catheter from left kidney, a piece of tuberculous material was drawn away in its eye. The operation was made in the usual manner, both lumbar and inguinal incisions being employed which incisions healed perfectly within six weeks.

*Post-operative Measurements.*—Bladder: Posterior wall, October, 1906, 2.2. cm.; March, 1907, 1.5 cm.; April, 1907, 2.5 cm. Vertex, October, 1906, 1.5 cm.; March, 1907, 1.2 cm.; April, 1907, 1.5 cm. Left cornu, April, 1907, 4.2 cm. Right cornu, March, 1907, 2.7 cm.; April, 1907, 2.7 cm.

*Loculus in Bladder.*—On posterior wall: Long diameter, 3 cm.; transverse diameter, 1.3 cm.; depth, 2 cm.

Again, abnormalities within the bladder can be measured

with considerable accuracy in the following ways: In the first place, a diverticulum in the bladder can be determined by measuring, first the distance from the internal urethral orifice to the margin of the diverticulum, either by carrying the speculum from the internal urethral orifice to the diverticulum and noting on its graduate cylinder the distance traveled, or by resting the end of the speculum at the internal urethral orifice and introducing a graduated rod as far as the edge of the diverticulum, measuring the distance on the top at the outer edge of the speculum, and subtracting the length of the speculum, gives the distance to the diverticulum. Then carrying the rod into the bottom of the diverticulum, the additional distance traversed is easily measured.

### CASE ILLUSTRATING MEASUREMENT OF LESION

Miss R., May 7, 1907. San. No. 2,443. Urethra, 4 cm. long; posterior wall, 2 cm.; vertex, 2 cm.; angle of vertex, 35°; left cornu, 3 cm.; right cornu, 3.75 cm.; cornual angle, 30°.

Transverse lesion in vertex, beginning with an area of ulceration in left cornu. Size: Five diameters of speculum, transverse at reflexion from vertex to posterior wall. Right ureteral orifice from interior of urethra, 1.5 cm.; angle right ureter, 35°; angle left ureter, 35°; catheter entered right ureter for 24 cm.

### LINEAR MEASURE; ULCERS

In measuring scars, or trabeculæ, or the size of inflammatory patches or ulcers in the bladder it is only necessary to know the exact diameter of the end of the speculum in millimeters and to bring this close to the lesion to be measured, then to lay it off on the diameter as the instrument is moved from side to side. The outer edge of the speculum each time is turned to occupy the position just held by the outer edge, in this way forming an imaginary row of tangential circles, as shown in the figure. Knowing the size of the lumen of the speculum, one can easily subdivide this by imaginary lines, say in a speculum 1 cm. in diameter, a line traversing its center, divides the area into parts, say 5 mm. each. and by subdividing these again it is easy to estimate even in millimeters. It is not necessary to touch the lesion to do this; the specu-

PLATE XXIII.—Presented by Dr. Howard A. Kelly.

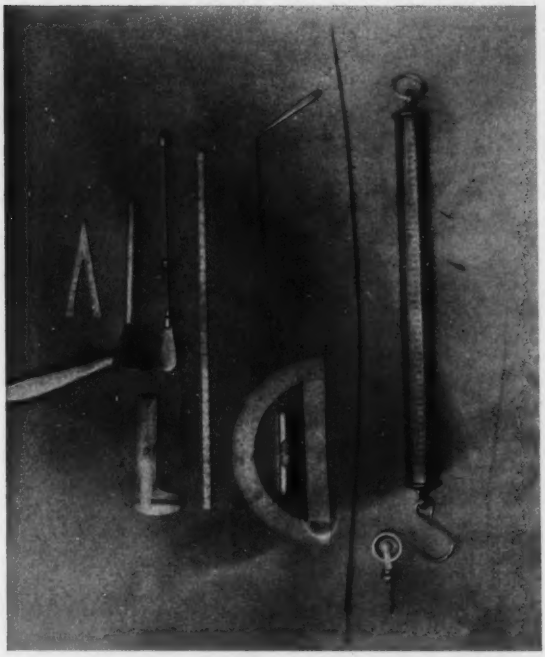


FIG. 3.—Instrument for measuring calibre and diameter of specula. V-shaped instrument. Sliding gauge for measuring diameter for small ureteral catheters. Semicircle for measuring angles in bladder. Level for establishing horizontal. Searcher for finding ureter. Ureteral catheter with stilette and rubber sleeve on end. Spring balance to test bite of stricture on catheter.

lum may be kept 1 cm. or more away. While thus traversing the wall of the bladder with the end of the speculum, the lesion may be plotted out and recorded in a greatly enlarged figure if desired, say three to four times normal size. One should always carefully note whether lesions are on the posterior or sacral surface, in the vertex which is inferior in the knee-breast position or the lateral walls, on the base or anteriorly on the pubic area, or retrosymphyseal.

### ANGULAR MEASUREMENTS

While the measurements given are exceedingly valuable in determining accurately the size and location of lesions, as well as the capacity of the bladder, they are not sufficient to give the form of the bladder. This must be determined by the addition of a series of angular measurements, to be made in the following way:

It is necessary to have two arms pivoted together at the end with which to make an angle and a graduated half circle with which to measure it. The angles are all measured from the horizontal as being most convenient.

Let me illustrate; The measurement to the posterior wall is a horizontal measurement. The speculum is then raised until its inner end is seen at the vertex. If one of the two arms is held horizontal the other is then dropped until it falls to the same angle as that in which the speculum lies, or it may be even introduced into the speculum, when the screw is set to fix the angle. The instrument is then withdrawn, the angle measured on the graduated half circle. I propose having these arms cross, and the graduated half circle set on the arms, when the angle can be measured at once. In a similar manner the angles of the cornua may be measured either from a vertical or horizontal arm. The distance of the base above the horizontal is also measured. Let me describe the utility of this procedure in plotting out a bladder.

Mrs. B., aged 39 years, May, 1907. This patient had been treated for ulceration at the junction of the posterior and baffondal walls of the bladder without relief. Some years ago she was treated for urethritis by putting a silver stick directly into the urethra. This caused sloughing of the entire urethra and complete loss of control of the bladder. To repair this a number

of operations were done, and, finally, a regular spout-shaped urethra was made. A pledget of cotton underneath this gives her fairly good control. Examination of the bladder showed it healthy except for the ulcer, which was 30 mm. long by 21 wide.

*Operation Measurement.*—The bladder measurements were: Urethra, 5 cm.; sacral wall, 3 cm.; vertex, 5 cm.; left cornu, 3.5 cm.; right cornu, 4 cm.

The angular measurements were as follows: Vertex, 50°; left cornu, 25°; right cornu, 25°.

The angulation and distance of the ureteral orifices is a matter of extreme importance, both in searching for the openings and in determining the presence of disease. A markedly diseased ureter is often retracted toward the cornu and drawn away a greater distance than its fellow from the internal urethral orifice. The orifices are often so distorted that one lies close to the median line, while its fellow occupies an extreme lateral position and it is of great interest to the specialist to notice all these asymmetrical cases.

NOTE.—In getting ureteral length, add length of catheter outside of speculum to length of speculum and deduct the sum from the total length of catheter.

Measurements in a normal case. Ureteral length equal 2.3 cm.

Miss B., May 3, 1907. San. No. 2,438.

*Bladder Measurements.*—Urethra, 3 cm.; posterior wall, 4.5 cm.; vertex, 6 cm., later, 7 cm.; left cornu, 7 cm.; right cornu, 8 cm.; left ureteral orifice from internal urethral, 4.25 cm.; right ureteral orifice from internal urethral, 4.5 cm.; length of ureter, 25 cm.

*Angular Measurements.*—Left ureter, 35°; right ureter, 35°; vertex, 45°; base, 20°; each cornu, 27°.

## URETER LENGTHS

The measurement of the length of the ureter ought to be made as a routine practice whenever the ureteral cathether is introduced. This is easily done: The ureteral orifice is exposed, the catheter stripped from its stilette into the ureter which it ascends until it touches the top of the renal pelvis. The ex-

perienced urologist recognizes this point by an almost imperceptible check in the progress of the catheter. He then stops at once for fear of bruising the pelvis of the kidney and causing hemorrhage. There are two ways of determining the length of the ureter plus the renal pelvis. One is with the vesical end of the speculum resting in the angle between the catheter and the bladder wall at the ureteral orifice, to measure the length of the ureteral catheter still outside the speculum. If the length of the speculum is added to this and the sum of these two figures is deducted from the known length of the catheter the distance the catheter has passed in ascending the ureter is easily determined. The other way is to withdraw the speculum and measure the length of the catheter outside of the body. Previous measurements have determined the length of the urethra and the distance from the urethra to the ureteral orifice. These three measurements being added together and deducted from the known length of the catheter, the length of the catheter inside of the ureter is ascertained. (See drawing.)

Out of 20 cases thus measured, the average length was 24.7 cm., the longest ureter being 30.5 cm. This differs to a remarkable degree from Quain's measurements given in his *Anatomy*, Vol. III, pt. 4, p. 204, where he states the ureters to be from 14 to 16 inches long, which is 35 to 40 cm. The difference is all the more marked when it is remembered that my own measurement includes the length of the pelvis of the kidney. Luschka estimates the length of the ureter (*Anatomy*, Vol. III, p. 294) as 27 cm., also greater than my measurements. Sappey's are closer; he states the ureteral length to vary from 25 to 30 cm. (*Traité Anatomie Descriptive*, Vol. IV, p. 529, fourth edition.)

The measurement of the length of ureter, or more particularly the measurements of the lengths of the left and right ureters in the same person as a basis of comparison, is a matter of extreme importance in some renal and ureteral diseases.

As an example, I give in one of my own cases (*Operative Gynecology*, Vol. I, p. 530) where there was fistula in the left groin, supposed to be due to carious vertebræ. In making a vesical examination I passed a renal catheter 26 cm. on the right side. The catheter stopped gently in the usual manner. On the left side the catheter stopped abruptly, and only passed in 23 cm.

and could not be coaxed further. The urine flowed freely from the right catheter; none at all flowed from the left, although the catheter remained *in situ* over an hour. In this way I diagnosticated the presence of an old abscess of the left kidney and operated and relieved the patient who has remained well since and is now married.

I have employed with success, in several cases of ureteral stone, a method which was originally suggested by Dr. Sampson, then my resident at the Johns Hopkins Hospital, and now gynecologist to the Albany Hospital. This consists in waxing the entire ureteral catheter, and passing it up to the kidney. On withdrawal, if a stone is fixed at some point in the ureter, there will be a scratch mark extending from the tip to this point and by measuring the length of it, one can determine the distance from the kidney, and also by employment of the other measures the distance from the ureteral orifice. By observation of the curves of the catheter an accurate estimation can be made as to just where it is located. An illustrative case of long-scratch mark is that of a patient who came to me complaining of severe pain.

Mrs. S. H., aged 37 years; October 15, 1906. San. No. 2,232. Severe pain in pelvis and in right side. The family history was unimportant (rather neurotic and eccentric), the patient well and healthy until marriage eight years before; there had been no children nor miscarriages. Inquiry elicited the fact that from marriage she had contracted severe genital and urinary gonorrhœa and there were a number of hemorrhages from the bladder. In June, 1903, she had appendectomy and suspension of the uterus by Drs. Finney and Russell, and in May, 1905, the right tube and ovary were removed by a surgeon in Hanover, Germany.

Physical examination showed a strong, healthy woman; no fever; urine normal.

Special physical examination, marked pelvic inflammatory disease.

*Operation.*—By abdominal incision a markedly inflamed left tube and ovary. Uterus removed. Kidney and ureter examined and found normal. Patient convalesced rapidly and completely from this operation, but continued having some pain.

*Measurements.*—January 11. Urethra and bladder are normal in appearance and the urine is normal; right ureter was entered by wax-tipped catheter 26 cm.; the pelvis contains 17 cc. fluid. January 23, pelvis contains 23 cc. fluid. February 19, 1907, right ureter 25.5 cm. long. Catheter wax tipped, a scratch on it 18 cm. long. By this the stone must have been up ureter 7.5 cm. Scratch probably an artifact.

DIAGNOSIS OF TUBERCULOUS KIDNEY MADE BY FINDING A STRICTURE. CASE IN WHICH A STRICTURED LEFT URETER DUE TO TUBERCULOSIS GAVE A PULL OF 200 GRAMMES TO LOOSEN A CATHETER WHICH HAD BEEN INTRODUCED IN THE STRICTURE

Mrs. E. H. C., aged 46 years; October, 1906. San. No. 2,302. The family history was good. The patient always very delicate, and when eighteen years old had a severe cough lasting for months followed by an attack of pain in left kidney region. A year later she had a great deal of bladder trouble which lasted for several months, but since that time there had been no trouble with the bladder. Since September, 1906, the patient had not been very well, nervous, and some pain in the rectum, while doctors had found tubercle bacilli in the urine. Temperature and pulse generally normal.

Physical examination showed the patient well nourished, but extremely nervous. The urine was found to contain tubercle bacilli; heart and lungs normal, the uterus, however, being the seat of a large myomatous mass. There was no elevation of temperature during her stay of several weeks in the hospital.

*Special Examination.*—October 29, the bladder was catheterized and the following measurements were made: length of urethra, 4.25 cm.; from external urethral orifice to right ureteral orifice, 5.5 cm.; to left ureteral orifice, 5.5 cm. The bladder is perfectly normal in appearance as are also the urethral orifices. The left ureter was catheterized and a few centimeters up an impassable stricture was met. The right ureter was easily catheterized along its entire length. The left and the right kidney were found secreting at about the same rate, and the left kidney as well as the right was secreting normal urine chemically and microscopically, a striking feature in view of the fact that the

bladder constantly contained some pus cells and red blood cells and no organisms except tubercle bacilli. (Unfortunately no measurements were taken.)

There was a pull of 200 grammes by the stricture of the left ureter. The reason that the left kidney was secreting clear urine at this time was explained by the condition of the kidney after its removal. It was found that the tuberculosis was limited to the pyramids of the anterior half of the upper pole. The calices supplying these pyramids were very tuberculous, whereas all the rest of the kidney, including both the secreting structures and the pelvis, was normal. On palpation the lower end of the ureter was thickened and tender, but the upper end was not tuberculous, as shown at operation.

On the finding of a stricture at the lower end of the ureter, a diagnosis of tuberculosis of this kidney was made and on October 19 a nephrectomy by lumbar incision was carried out.

This patient has done perfectly well since her operation in spite of the large myomatous uterus.

WHERE MEASUREMENT DISCLOSED A STRICTURE IN THE URETER

Mrs. L. B. C., aged 38 years; May 5, 1906. San. No. 2,176.

*Diagnosis.*—Tuberculosis of the right kidney, ureter, and bladder.

*Operation.*—Right nephrotectomy. Complaint: burning and frequency of micturition.

The family history was negative and her past history showed, in 1892, tuberculosis of the rib and pleurisy, and at the present time tuberculosis of the ankle. The patient was a well-nourished, healthy-looking woman, with no fever or evidence of pulmonary tuberculosis.

On special examination neither kidney was palpable. Right ureter thickened and tender. Left, normal to palpation. Bladder diffusely inflamed. Right ureter catheterized; catheter only goes up 23 cm. from external urethral orifice, whereas catheter goes up 33 cm. in the left ureter. Urine containing 2% urea and without pus or bacteria obtained from the left kidney. In twenty minutes there was no flow from the right kidney; from the bladder urine were obtained tubercle bacilli. By a lumbar incision

and then an inguinal incision, the kidney and ureter were removed. This patient has improved greatly since operation, her bladder having ceased to give symptoms and urine become almost normal.

As no urine was obtained from the left kidney, the stricture was a most important finding.

This method is also of great value in cases of congenital *misplacement of the kidney* or of displacement of the kidney with *large hydronephrosis in which* the ureter is shortened and flattened on the sac *so that the catheter* cannot enter the usual distance. If the catheters are inserted into both sides in such cases and then grasped firmly at the external urethral orifices and withdrawn simultaneously a striking picture is secured. (See Fig. 1.)

A great deal is to be learned from the *form impressed upon the catheter* by the moist, warm tissues of the body after it has been left in the ureter at least a few minutes. If a good, fairly soft catheter is used and on removal is immediately laid upon a cold surface, such as a sheet of glass, in normal cases the catheter assumes a characteristic form with two gentle curves at average distances of 15 cm. and 22 cm. below the tip. (See Fig. 2.)

*Alongside of this normal* catheter, I give several illustrations of the effect upon the curves of the catheter wrought by introducing it into abnormal ureters. A large hook-shaped curve was obtained from a pus-kidney case which I had many years ago.

The second one is from a woman upon whom I operated for hydronephrosis at the Johns Hopkins Hospital in March, 1906.

A third type is shown where there is a sharp angulation of the upper end of the catheter, due probably to its entering a calix. Such an angulation would, of course, seriously interfere with the outflow of urine, and it is this condition perhaps that we have in cases where we diagnosticate a plugging of the eye of the catheter and yet, on drawing it out a little way, the flow begins.

The tightness of a stricture of the ureter is measured by a *delicate tension* instrument which I have made and which works in the following manner: A string is fastened on to the ureteral catheter, caught in the bite of the stricture, and is passed over the pulley in order to secure a vertical pull. The instrument is then hooked into a loop in the string and pulled upon until the

catheter begins to move, the maximum tension being noted. In a case of tuberculous stricture, I found the pull was 200 grammes. The size of the catheter must always be noted, as the larger the catheter the stronger the bite. The value of this method is two-fold; in the first place it gauges accurately the degree of stricture and enables different observers to make accurate comparisons between their cases, which has hitherto been impossible. It also enables the observer to test improvement as he treats a stricture by successive dilatations.

Miss W. Cystoscopic examination. In knee-chest position: Length of speculum, 12 cm.; urethra, 4 cm. long; sacral wall, 6.5 cm. long; vertex, 6.75 cm. long; left cornu, 7 cm. long; right cornu, 6 cm. long; angle at base, 22°; angle at vertex, 55°; angle left cornu, 40°; angle right cornu, 45°. Left ureteral orifice: External urethral orifice to left ureteral orifice, 6 cm.; angle of left ureter, 15°. Right ureteral orifice: External ureteral orifice to right ureteral orifice, 6 cm.; angle of right ureter, 22°. Catheterization of right ureter: Amount of catheter outside ureter, 47 cm.; as catheter is just engaged in stricture, length of catheter is 47 cm.; amount of catheter outside of ureter, 24.5 cm.; rest of catheter in ureter. Measure of pull with instrument: 180, 190 maximum pull; amount of catheter just outside of stricture is 42 cm.; length of catheter is 50.5 cm. to tip; no scratch mark.

Measurements of the capacity of the pelvis of the kidney are of the utmost importance. By means of these I have been able to discover a whole realm of renal affections, namely, the hydronephroses of lesser grade, beginning with slight distentions of the pelvis of the kidney and extending up to those holding as much as 1250 cc. If a diagnosis of hydronephrosis can be made in the earliest stages, it is manifestly a matter of high importance as the disease is then easily amenable to surgical treatment, while in the advanced stages of the disease, in which it is commonly recognized, often nothing can be done but extirpate the kidney.

The technique which I am now employing for grading the sizes of hydro- and pyonephrosis is essentially that which I have been using for some years, although there are constant small changes in instruments and in methods to facilitate the work. The technique can be schematically considered under three steps or maneuvers.

First step: After introducing a ureteral catheter into the pelvis of the kidney, accurate observation and recording of the character of the flow of urine and the amount of flow by minutes is made.

A large renal catheter, measuring from 2 to 2.5 mm. should be used, as thus a good conduit is secured, and thus all reflux around the catheter guarded against. In case the kidney is a normal one, the urine after the first 2 or 3 cc. will be observed to flow intermittently. There will be a systole bringing down a few drops of urine and then a diastole. In a dilated hydronephrotic pelvis the flow is very different; there will be a continuous drop, drop, drop, until the pelvis is emptied and after that there will be a slow, sluggish dropping. The amount of flow from such a hydronephrotic kidney can also be very great within a short time.

CASE ILLUSTRATING HOW A KIDNEY STIMULATED TO HYPERSECRETION MAY GIVE A FLOW THROUGH A RENAL CATHETER, SIMULATING HYDRONEPHROSIS

Mrs. L. S., aged 33 years; March, 1907. San. No. 2,357.

*Diagnosis.*—Closure of the ureter by a cancer metastasis in the neighborhood of the vesical end of the ureter.

*Clinical Facts.*—This patient had been suffering with excessive hemorrhages and vaginal discharge for a number of months when she came to me in November, 1906. Examination showed her symptoms to be due to an extensive carcinoma of the cervix uteri. Although the case was a borderline one, it was decided to give her the advantage of doubt and an extensive abdominal operation along the lines suggested by Wertheim was performed. The left ureter was injured in this operation as it was stripped quite bare in order to remove all growth. Some weeks following operation there developed a fistula of the left ureter, through which the entire output of the left kidney escaped. This kidney became infected and underwent severe, chronic, interstitial, nephritic changes, so that in a few months, although the water constituents of the urine was secreted in large amount and gave the patient much discomfort, there was no urea, or practically none. In consequence, after consultation, the left kidney was removed. For a time the patient did very well, then without

warning there appeared anuria. All the ordinary methods of giving diuretics, putting warm poultices on the back, etc., were tried and did not relieve this condition, the patient developing anasarca and slight uremic symptoms. With the intention of irrigating the pelvis of the kidney with hot salt solution to stimulate the kidney, I catheterized the ureter and at once clear urine began to be secreted in an almost continuous stream. In the first minute there was secreted 10 cc.; in the second, 10 cc.; in the third, 10 cc.; and for four hours the kidney continued secreting on an average of 8 cc. per minute, and in twenty-four hours secreted 6 liters of urine containing 80 grams of urea.

It is, of course, very exceptional for two kidneys under any conditions to secrete within twenty-four hours the amount of urea and the amount of fluid that this single kidney secreted. The circumstances were unusual as there was a huge heaping up of waste products and fluid in the tissues by the suppression of urine for more than twenty-four hours due to the obstruction of the ureter by nodular cancer. In this case, as soon as the ureteral catheter came out, the patient immediately ceased excreting urea.

While the injection is being carried out a small, glass catheter should be in the bladder, and the slightest appearance of colored solution through this signifies a reflux around the ureteral catheter, and demands the employment of a larger size. The total amount injected is noted and recorded.

The second step consists in the recollection of the aniline solution, which is allowed to flow back through the catheter. This should be done until the solution has lost its blue color and assumed a light, greenish tinge. The character of this flow and the amount admitted should also be most carefully observed. The figures obtained by these measurements give a fairly accurate estimate of the size of the renal pelvis and its associated calices. Out of 40 *cases with presumably normal* kidneys, since injection gave a pain entirely different from anything the patient had ever had before, the *average capacity was found* to be 8 cc., the smallest capacity 2 cc., and the largest 20 cc. This average capacity of 8 cc. corresponds very closely with the measurements obtained by Mr. Broedel on autopsy kidneys. On a large series of cases he found that 7 cc. represented the average capacity of a normal pelvis. The frequency of dilatation of the pelvis in stone and

tuberculous cases and also in movable kidney is illustrated by the fact that in 65 cases the average capacity was found to be 12.7 cc. This group of cases does not include any in which genuine hydronephrosis was suspected.

Mrs. S., Johns Hopkins Hospital, Ward H., January 8, 1907.

*Diagnosis.*—Stricture of right ureter at level of pelvic brim.

*Operation.*—Exploration of ureter with release of constricting band and dilatation of ureter, extraperitoneal.

*Findings at Operation.*—A large dilated hydro-ureter above, with a constriction at the level of the pelvic brim, the ureter below the constriction being in every way normal. Before operation and during an acute attack of renal colic, the right ureter was catheterized and 60 cc. of urine obtained immediately. Sixty cc. were then injected into the right ureter before pain was brought on.

*Cystoscopic Examination.*—January 8, 1907. The bladder looks normal. The right ureteral orifice is normal; the left orifice normal. A No. 10 cystoscope used. Patient in the knee-breast posture. A large renal catheter with wax tip was passed easily up the right ureter, the catheter being passed into the ureter for a distance of 22 cm. A smaller catheter was passed into the left kidney. There immediately flowed from the right side 12 cc. of clear urine; also from the left side 12 cc., the patient being in the upright position on her knees. (The patient has been drinking water freely previous to examination.) She was then placed on the left side. The rate of flow from the right side was intermittent —4 cc. to the minute. The right side was then injected with methylene-blue solution; 25 cc. of the solution brought on pain, whereas before the operation 60 cc. were required to bring on pain. As soon as the pain started, patient was raised in the upright position and the urine from the pelvis collected. There was an immediate flow of about 18 cc. On withdrawing the catheter 5 cm., 2 cc. were obtained; on withdrawing 4 cm. more, 2 cc., on withdrawing 4 cm. again no immediate flow, but normal, intermittent flow obtained. The catheter at this point was only 9 cm. in the ureter.

There was some reflux on injection, possibly of 20 cc., and this probably, with a part of the urine which would naturally have remained in the enlarged ureter, escaped around the catheter into the bladder as the catheter was withdrawn by degrees. There-

fore, a better demonstration of the actual presence of a hydroureter was not possible.

The right ureter was catheterized and a scratch mark was obtained. The resident, Dr. Hutchins, explored the ureter but could find nothing but a stricture at the pelvic brim. An X-ray picture was taken and a report of "no stone" was made.

I catheterized the kidney and got a definite wax tip scratch; on this finding the ureter and the kidney were explored and a large ureteral stone found with the hydronephrotic kidney. The X-rayist on revising his findings determined that he had the sides of the plate mixed and that a stone was actually present. Although this was the fault of the operator and not the X-ray method, it should be recorded as a failure of the X-ray.

### CASE ILLUSTRATING THAT BY INJECTING THE KIDNEY, THE LOCATION OF PAIN MAY DEPEND UPON THE LOCATION OF THE KIDNEY. THIS CASE OF PELVIC KIDNEY INJECTED, CAUSED PAIN IN THE PELVIS

Ida T., aged 33 years, colored woman; Cambridge Hospital, March 28, 1907.

*Diagnosis.*—Pelvic kidney (left), and adherent ovarian cyst (left). The family and past history was negative. Her present illness had lasted eighteen months. She first noticed a small tumor in left side the size of an orange which had been growing continually and occasioned much pain. No trouble with micturition. Menstruation regular and not excessive. "Never pregnant." Bowels constipated.

*Physiological Examination.*—Normal temperature, pulse, and leukocytosis and urine; abdomen occupied by a large, cystic tumor; uterus outlined anteriorly.

*Operation.*—March 1, 1907. A median abdominal incision. Large cyst springing from the left ovary, and filling the entire pelvis and lower abdominal cavity, made out, densely adherent to the rectum, omentum, some loops of small intestine, and the uterus. This was partly evacuated and then cut free with scissors from its attachments. After removing the cyst, examination showed a small body in the pelvis lying behind the peritoneum and in the hollow of the sacrum; this was a normal-shaped kidney,

its pelvis facing outward in place of inward, with blood supply seeming to come from the aorta. The abdomen, after controlling all hemorrhage and covering the raw areas with peritoneum, was closed in layers with cat-gut.

Examined per rectum after operation, the kidney was felt in position described. While the abdomen was open, the right kidney was palpated and found to be a little lower than normal, being situated behind the upper part of the cecum; it was moderately movable. Patient convalesced without any untoward symptoms.

On March 28, cystoscopic examination in knee-breast posture: Bladder vertex, diameter 5 cm.; bladder fundus, diameter 5.5 cm.; from interior urethral orifice to left ureteral orifice, 1.5 cm.; right, 1.5 cm.; urethral length, 4 cm.; length left ureter, 12 cm. and renal pelvis; length, right ureter, 25.5 cm. and renal pelvis.

Both kidneys secreting clear, normal urine in the normal spurting ejaculatory way.

Into the left kidney 8 cc. of a sterile suspension of bismuth subnitrate in salt solution was injected. *This brought on a typical attack of colic (injection), except that the pain was not referred to the loin but to the pelvis where the kidney lay. On letting the fluid run out the pain quickly disappeared.*

An X-ray, immediately taken, shows kidney pelvis and ureter.

The interest in these cystoscopic findings lies in the fact that it offers an absolute method of diagnosticating a pelvic misplaced kidney.

Problem: An unknown mass to right of rectum not sensitive is felt in the pelvis.

Solution 1. The ureter is found to be very short on the side of the mass.

Solution 2. Injecting the ureter causes colicky pain in mass.

Solution 3. Injection of bismuth and an X-ray picture complete diagnosis.

As the kidney had never occasioned any distress and was functioning normally, there was no occasion for further interference.

### FIRST CASE OF HYDRONEPHROSIS CALIBRATED

Mrs. J. M. DeL., aged 43 years, Lisbon, Howard Co., Maryland, January 25, 1895.

*Complaint.*—Growth in right side of stomach.

*Menstrual History.*—Regular, lasts four days, moderate.

*Marital History.*—Six children, 22 to 11 years; first instrumental, no miscarriages.

*General Appearance.*—Pale, sallow, slight.

*Present Illness.*—Since birth of last child, pain in limbs. Bowels constipated, no urinary difficulty. The patient for six years has had spells of severe pain in right side which is usually accompanied with marked disturbance of micturition. The pain may last a day or two, and is usually accompanied with nausea, vomiting, and fever.

*Physical Examination.*—A mass was present in the right side 13 x 10 cm., comes within 3 cm. of the umbilicus in front. It disappears in the renal region behind the ribs. It shows tympany over its entire anterior surface. The liver dulness is normal.

*Special Examination.*—On January 25 the right ureter was catheterized and it secreted in twenty-six minutes 125 cc. This urine was faintly acid, had a specific gravity of 1007, contained a trace of albumin; it contained no pus or blood. The left ureter secreted transvesically 23 cc. in fifty-five minutes. This urine had a specific gravity of 1019 and a faint trace of albumin. There were no pus or blood cells. The percentage of urea in the left kidney was 0.255, and in the right kidney 0.039. The flow from the hydronephrotic kidney was continuous and sluggish; during the first six minutes 40 cc. were secreted, and in twenty-one and one-half minutes 140 cc., and in twenty-six minutes 155 cc. After the withdrawal of this fluid, the tumor mass in the right side was about half the size it was before; became distinctly fluctuant and lost all feeling. This loss of tension in a large hydronephrotic kidney has been well illustrated in some of my other cases, and can be recorded accurately by the piezometer.

### VERY LARGE HYDRONEPHROSIS

Mrs. M. D., aged 48 years, white. Gyn. No. 12,742. Admitted March 2, 1906; operation March 5; discharged April 2.

Diagnosis: Hydronephrosis, right. Operation: Nephrectomy, right.

*Complaint.*—Pain and swelling in right side.

Family and past history negative. Menopause occurred two years ago. No disturbance with it. Has had three children. No trouble with the bladder or frequency of micturition.

*Present Illness.*—Began fifteen years before coming to the clinic, with slight pain in right side. Pain at first came on about once a month and lasted an hour or two at a time. Five years ago a tumor mass was noticed in the right side. This was present for ten months, and she then had a severe pain for ten days and the tumor mass disappeared; from this time until October, 1905, there was no pain. She then noticed the mass in the side again and some pain. Ten days ago it began growing rapidly and causing a great deal of pain.

The general examination shows a weak-looking woman; normal heart and lungs. The abdomen was distended by a large, cystic-feeling tumor, filling the entire right side of the abdomen. This mass is 21 cm. long and 14 cm. across.

The right ureter was catheterized with a wax-tip catheter, which showed no scratch marks after its removal. The catheter was introduced 11 cm. into the ureter; at the same time the catheter was introduced into the left ureter for 18 cm. Both ureteral orifices and the bladder looked perfectly normal. There began an immediate flow of urine from the left side in the characteristic spurting manner of the normal functioning kidney. *In the first minute* 4 *cc. were secreted, in the second minute* 2.5 *cc., in the third minute* 7 *cc., in the fifth minute,* 8 *cc. During the same time there was no flow whatever from the right side*; 210 *cc. of aniline solution was injected into the right ureter causing the tumor to become tense, hard, and painful. There was no flow back, however.* A diagnosis of a hydronephrotic kidney with the valvular closure of the upper end of the ureter was made.

*Operation.*—An oblique incision was made through the linea semilunares down to the peritoneum. An attempt was made to strip the peritoneum back from the tumor mass, but as this proved difficult the peritoneum was entered and the kidney enucleated without great difficulty. A gas anæsthesia was employed throughout. Patient did very well after this operation and went out of

the hospital well. It should have been stated that the examination of the urine showed that it was normal. An examination of the specimen after its removal showed an enormous hydronephrotic sac which contained 1250 cc. of fluid. The ureter, which ran over its anterior face, was gradually closed off by the pressure of the tumor.

### LARGE HYDRONEPHROSIS TREATED BY PLASTIC OPERATION ON URETERAL ORIFICE

Mrs. A. K. (San. No. 1,194), aged 56 years, the mother of four children, came to me June 15, 1901, from Dr. Fletcher Lutz. With the exception of typhoid fever and some "kidney trouble" with her second child, she had always been a hearty, hard-working woman until the past six years, when her present invalidism began. She began first with a feeling of weight and discomfort in her right side, accompanied by a constant feeling of fullness with flatulence and marked constipation. These discomforts were associated with occasional attacks of acute pain in the side, accompanied by nausea and vomiting and palpitation. Five weeks before I saw her a lump was noticed in the right side below the rib for the first time.

She had been rapidly losing weight and strength and had a cachectic appearance. The hemoglobin was 58%, the appetite was very poor, and there was some nausea and often vomiting.

*Under the impression that the fluctuating cyst was a gall-bladder, an interior incision was made along the outer border of the right rectus muscle, when the tumor was found to be a large hydronephrotic kidney extending up under the gall-bladder. The duodenum was closely attached* to its inner border. A band stretching across the sac proved to be a large artery which showed no signs of pulsation until the cyst was evacuated. Just below this band and in front of the sac the ureter was found. On squeezing the mass, the ureter filled with fluid and stood out prominently. In this way the whole sac was emptied.

*Operation.*—The peritoneum was opened on the posterior surface and the duodenum dissected off from the sac and pushed inward and downward. The ureter was next dissected loose from the sac and raised up and an incision made at the angle of the

junction of the ureter with the renal pelvis, extending for 1 cm. in either structure. The ends of the incision were then united with fine-silk suture, left long, but not tied. This served to regulate the application of the remaining silk mattress sutures, which were introduced 2 mm. apart and tied so as to unite the ureter to the pelvis of the kidney, in such a manner as to keep patulous the incision, doing away with the valve-like opening causing the retention of the renal secretions. Upon squeezing the pelvis of the kidney after tying all the sutures, it was seen that the fluid readily escaped from the kidney down the ureter. The kidney was so large and flaccid, being about 18 x 12.5 cm., that it was thought best not to attempt to suture and suspend it, but to rely upon the free opening into the ureter to prevent future accumulations. The patient made a good recovery and has since remained in excellent health.

ILLUSTRATION OF THE DIFFERENCE IN FLOW FROM RENAL CATHETER FROM A HYDRONEPHROTIC AND FROM A NORMAL KIDNEY

Mrs. S. J. F., aged 47 years; No. 2,079. February 6, 1906.

*Diagnosis.*—Infected hydronephrosis, right.

*Treatment.*—Irrigation of the pelvis of the kidney with 1 to 1000 silver nitrate solution.

Family history unimportant, as is also the past history. Menstruation is irregular, but is of normal amount and painless.

*Present Illness.*—Has been an aching in the right side; this varies in intensity, occasionally being quite severe. *Six weeks before admission for the first time, a violent attack of vesical pain* with frequency of micturition set in and lasted several days. Every month or two there *are severe headaches.* The patient has noted *that following the headache there is a large output of urine.*

*Physical Examination.—A general physical examination shows nothing;* the temperature is normal, as also the pulse. *Neither kidney is tender or palpable.* The pelvic organs are normal except for a relaxed vaginal outlet and a retroflexion of the uterus.

The bladder examination shows a normal bladder, except that both ureteral orifices are surrounded by red, inflamed areolæ.

*The ureters catheterized, first the right; there was an immediate*

*steady flow of* 15.5 *cc. in the first minute; in the second minute there were* 7 *cc.; in the third minute* 7*cc.; in the fourth minute* 8 *cc.; in the fifth minute* 9 *cc.; in the sixth minute* 2 *cc. The flow was almost constant, drop, drop, drop, until* 40 *cc. were reached; then the intermittent ejections began.* Thirty cc. of boric acid solution were injected into the pelvis of this kidney without pain. The wax tip on the end of the catheter was not scratched.

*The left kidney then catheterized. In the first minute* 6 *cc. obtained; in the second minute* 5 *cc.; in the third minute* 3 *cc.; and in the fourth minute* 4 *cc.*

The urine from the right kidney was colorless, clear, acid, contained no albumin or sugar. A few red blood cells, a very few pus cells, renal epithelium, and the colon bacillus.

The left kidney was secreting a clear urine; acid, without albumin or sugar; without pus cells or bacteria. Water had been given to the patient before the examination and a polyuria produced. The right kidney secreted 59 cc. of urine of 0.15% urea in eight minutes, while the left in the same eight minutes secreted 115 cc. of 0.05 urea. The right kidney was irrigated a number of times, and on April 26 the patient had normal urine. The right kidney's pelvis held 55% before pain was produced.

### THE DISCOVERY OF AN UNSUSPECTED HYDRONEPHROSIS OF THE LEFT KIDNEY

Mrs. M. J. C., aged 31 years; admission No. 2,034. December 8, 1905.

*Diagnosis.*—Hydronephrosis, double, with movable kidneys.

*Operation.*—Plication of the pelvis.

Family history negative except that there were two sisters who died of tuberculosis.

Past history: was well up to the present illness, which began with the pregnancy one and one-half years before coming to me. In the fifth month of this pregnancy she was seized with severe pain in the right renal region and after the onset of the pain the discharge of a large amount of pus in the urine was noted. From that time on until the very long and difficult labor, the patient had almost weekly attacks of pain in the kidney. After the labor these attacks have been coming on about once a month. During

an attack the patient notes the formation of a tumor in the right side of her abdomen, which disappears with the discharge of pus by the bladder. Several consultants had diagnosticated a pyelitis of the right kidney, and her physician, Dr. Guthrie, had determined the presence of a right pelvic peritonitis with adhesions.

*General Physical Examination.*—This patient is thin, having lost in weight from 145 to 109 pounds; is slightly anemic; hemoglobin 70%; the heart and lungs are normal, however, and neither kidney is palpable.

*Bladder Examinations.—The bladder and urethral orifices are normal. The right kidney was catheterized and 80 cc. of aniline solution injected without causing pain. The 60 cc. of this flowed back immediately and continuously. The left kidney was then catheterized and 35 cc. injected, causing pain. Neither kidney gave evidence of stone by the wax tip. Both the right and the left kidneys were markedly movable. The uterus is retroflexed.*

The urine from the left kidney is normal, there being no pus cells and no bacteria. That from the right kidney contains the colon bacillus, a few pus cells, and a few red blood cells. The tubercle bacilli were searched for carefully and not found.

The temperature and pulse in this case were normal and there was no increased leukocytosis.

The following operations were done: Repair of a relaxed vaginal outlet; removal of the vermiform appendix; removal of an adherent right tube and ovary; suspension of the uterus by means of its round ligaments; plication of the pelves and suspension of both kidneys. The kidneys were approached by the usual incision which I employ for exposing the kidney. I begin in the angle between the twelfth rib and the thick muscles of the back and extend forward and downward, striking what I have named the superior triangle. After opening Gerota's capsule, the kidney was brought into view. The large, flaccid pelvis with its thickened wall was then plicated by passing three silk sutures so as to gather up the entire pelvis in a V-shape, one inside the other and only on the posterior surface. Each suture started by transfixing the margin of the kidney surrounding the pelvis, and was then carried down into the pelvis toward the ureteral orifice, picking up the tissues of the pelvis without penetrating the mucosa, and catching the strong peripelvic fascia, as in the last case, on the

extreme edge of the pelvis. The suture then returned and emerged on the margin of the kidney. After passing three sutures in this way, they were drawn up so as to pucker and draw the pelvis together, when they were tied each to its own end, respectively. The kidney was then suspended to the posterior abdominal wall by three silk sutures in the manner which I am accustomed to employ.

This patient has done splendidly since her operation and reports herself in excellent health.

### CASE OF MILD HYDRONEPHROSIS DUE TO MOVABLE KIDNEY CURED BY SUSPENSION

Mrs. K. H., aged 39 years. Gyn. No. 10,697; September 3, 1903.

*Complaint.*—Dull, aching pain in the left side.

*Family History.*—Negative.

*Past History.*—Was well until birth of child and began having pain in the side. The patient has been married a number of years and has had six children. Her labors were all normal and there were no puerperal complications. There had never been any bladder trouble at any time.

*Present Illness.*—The patient states that for several years there has been a dull aching in the right side. This is never entirely absent, but is more severe during menstruation and when she is on her feet.

*General Physical Examination.*—The patient is fairly well nourished. No evidence of disease in the chest. The abdominal examination is negative except that the left kidney is felt movable to the third degree. The pelvic organs are normal feeling. There is no thickening of either ureter. In order to make sure that the pain was due to the movable kidney, cystoscopic examination carried out. The bladder was found to be normal. Both ureteral orifices were normal and normally situated. The urine obtained from the bladder perfectly normal. *The left kidney was catheterized and 50 cc. of aniline-colored solution injected. This brought on a definite pain which patient identified as that which she had been having. Upon this finding a diagnosis of movable kidney with mild hydronephrosis was made.*

*Operation.*—Suspension of the kidney in the usual way.

*Result.*—This patient writes in April, 1907, three and one-half years after operation, that she is and has been perfectly well. She promises to present herself to have pelvis of kidney measurements.

### MOVABLE KIDNEY WITH A MILD GRADE OF HYDRONEPHROSIS CAUSING ATTACKS OF JAUNDICE, RELIEVED BY SUSPENSION OF THE KIDNEY

Miss B. E., aged 48 years. San. No. 2,200; May 29, 1906.

*Family History.*—Negative.

*Past History.*—Patient has always been well until the present trouble.

*Present Illness.*—In June, 1905, the patient had a most severe attack of pain in the right epigastrium, associated with nausea, vomiting, and severe jaundice. The pain radiates to the shoulder. These attacks, which last from a few hours to a day or two, have recurred frequently since then. Fever and sweats accompany attacks. A constant ache is also present in the side between attacks.

*General Physical Examination.*—Very sallow. Temperature and pulse are normal. There are no abnormal elements in urine.

*Special Examination.*—Urethra and bladder normal.

*Measurements.*—To posterior wall of bladder 6.5 cm.; external urethra to right ureteral, 8 cm.; catheter enters ureter 25 cm.; *pelvic capacity 20 cm., and this causes pain of a different nature from that complained of—which note.*

*Operation.*—Gall-bladder normal. Slight stricture of pylorus of stomach and, therefore, a pyloroplasty; appendectomy; suspension of right kidney. The kidney pressed on common bile duct. This patient has had complete relief.

I wish to thank my associate, Dr. C. F. Burnam, for his kind help in studying many of these cases and in preparing this manuscript

# A CONSIDERATION OF THE PATHOLOGY, DIAGNOSIS, AND TREATMENT OF ACUTE UNILATERAL SEPTIC INFARCTS OF THE KIDNEY

By GEORGE EMERSON BREWER, M. D., of New York

ONE year ago the writer presented a paper to the Chicago Medical Society, entitled *Some Observations Upon Acute Unilateral Septic Infarcts of the Kidney.*

In that communication he reviewed the entire subject of hæmatogenous renal infection, called particular attention to the acute unilateral variety, spoke of its obscure symptomatology, its rapidly fatal progress, and its successful treatment by early nephrectomy. At the same time the writer described a series of laboratory experiments undertaken to ascertain if possible the various ætiological factors present in these cases. These experiments demonstrated the necessity of two essential conditions, namely, a bacteriæmia and a diminished resistance on the part of the tissues of one kidney; they also clearly indicated the effects of trauma, calculus disease, and renal retention, as determining causes of the unilateral character of the lesion. The paper was illustrated by numerous photographs of the gross lesion, as well as a few microphotographs of the histological appearances in both the human and experimental varieties.

Since the publication of that paper a number of successful cases have been reported to the New York Surgical Society, and the criticism has been made that nephrectomy is not always necessary in these cases. In my former paper I was dealing only with what might be termed the peracute form of the disease, in which nephrectomy is absolutely necessary to save life; and although I distinctly indicated that the milder varieties of the malady could be treated by less radical measures, I feel that it is desirable to present another communication on the subject in which the milder as well as the severer types of the affection will be considered.

The disease, like appendicitis, lies on the border line between medicine and surgery, in that in its milder manifestations it frequently recovers spontaneously, while its severer types require

prompt surgical treatment; unlike appendicitis, however, its symptomatology is still obscure, as in the majority of instances the condition is unrecognized or wrongly diagnosticated in the early stage when treatment is most effective.

It is a well-known and generally accepted fact that during the progress of any acute infectious or septic disease certain micro-organisms, giving rise to the symptoms, find their way into the blood current, and are either destroyed by the bactericidal action of the blood itself or by substances encountered in the passage of the blood through certain organs, or they are excreted through the kidneys. Pernice and Scagioni in 1894 published in Virchow's *Archives* the results of an elaborate series of experiments showing the anatomical changes occurring in the kidney by the excretion of various pathogenic and nonpathogenic bacteria.

Albarran in his admirable thesis published in 1889 reviewed the entire subject of renal infection, and concluded that ordinary pus cocci may under certain conditions be eliminated through the kidneys without producing marked anatomical lesions; their elimination, on the other hand, may give rise to a bacteriuria, to a glomerular nephritis with degeneration of the epithelium, to multiple nonpyogenic infarcts, to pyogenic infarcts giving rise to multiple abscesses, to perinephritic abscess, to pyelonephritis, or to a rapidly fatal toxæmia. He also stated that the effects of trauma, excessive functional activity, the presence of toxic products, and renal retention, all served to accentuate the process and to favor the formation of graver lesions.

The presence in the blood of pathogenic micro-organisms capable of producing metastatic accidents in the kidneys may, according to Israel, arise from absorption from the intestine, from acute infectious diseases, from local suppurations, as furuncles, carbuncles, paronychias, etc., and also from infection of the lower urinary passages.

It would naturally be inferred that such blood infections would produce bilateral lesions, but Simon, Alexander Johnson, and others have emphasized the fact that in a large number of cases of hæmatogenous infection the renal lesions are unilateral; the cause which determines the lesions in one kidney only being a diminished resistance of that organ as a result of previous disease or injury.

In enumerating some of the predisposing factors, Israel mentions calculus disease, ureteral obstruction producing renal retention, trauma, floating kidney, etc., as frequent determining causes of unilateral lesions. Singer, in 1883, reported a case of unilateral renal suppuration occurring during an attack of typhoid fever in a kidney severely injured eighteen years before the attack. Quincke reports a similar case seventeen years after such an injury. Numerous other examples of unilateral renal suppuration following trauma are reported by Simon, Tuffier, Rayer, Johnson, Rosenburger, and Levi. Regarding the infecting agent in these cases, Israel considers the colon bacillus the most frequent, but also reports cases due to the streptococcus and *Staphylococcus aureus*. Alter has reported a case of unilateral renal abscess in which the pneumococcus was demonstrated. Cases due to the typhoid bacillus have been reported by Singer and Comba. Cohn in 1902 reported 4 cases of suppurative nephritis in which the infection was traced to furuncles, in one of which the presence of a calculus was evidently the determining cause. More recently Jordan has reported 12 cases of renal and perirenal suppuration in which small foci of peripheral infection were considered as ætiological factors.

It will thus be seen that hæmatogenous infection of the kidney has been recognized for many years, that the various pathological changes in the kidney substance as the result of such blood infections have been well worked out by the pathologist, and the relationship between this form of infection and the more easily recognized gross renal suppurations has been admitted by most clinical observers.

It seems to the writer a matter of considerable surprise that while all of this work was being carried out no one seemed to recognize the most serious and important clinical type of acute hæmatogenous renal infection, or, if they recognized it, they failed to place their observations on record or describe it clinically.

So far as I have been able to ascertain, it was not until the publication of my original paper on the subject, in May, 1906, that the disease was described as a distinct pathological entity.

In that communication, after referring to the ætiology of pyonephrosis, pyelonephritis, and perinephritis, I stated that

"in nearly all the cases to which reference had been made the disease was well advanced, and one or more fairly large collections of pus were found. It is not, however, of these easily recognized terminal conditions of renal infection that I desire to speak, but rather of the earlier stages of the process, when the clinical picture is often one of an acute general infectious disease, in which the local manifestations are so slight, and so generally overshadowed by the symptoms of general toxæmia, that they are frequently overlooked, unless a more than ordinarily careful physical examination is made. These cases are often so acute in their onset, and so rapidly progressive in their septic manifestations, that death may ensue before any distinctive renal or urinary symptoms are observed."

CASE 1. My first observation of this severe type of renal infection occurred eleven years ago at the City Hospital. The patient was a female, aged 20 years, admitted to my service, suffering from double femoral fracture and multiple contusions of the body. After some three weeks of treatment, during which there were no evidences of disease or infection of any kind, she suddenly became violently ill with symptoms suggesting an attack of grip. The temperature rose to 104° F. or more; the pulse was accelerated; she complained of pain in the back and extremities. After two or three days of observation, a careful examination revealed tenderness over the right kidney, albumen and pus in the urine. Exploratory nephrotomy was advised, and refused by the patient. The symptoms increased in severity; she complained of constant aching pain in the right flank, had a number of chills, became delirious, and presented every evidence of a profound and rapidly progressive sepsis. At no time did she complain of pain or tenderness over the left kidney. Consent was finally obtained for operation.

Under general anæsthesia, the right kidney was exposed by a lumbar incision. The perirenal fat was found to be œdematous, the surface of the kidney was studded with deep red elevated lesions. On incising the cortex, the entire parenchyma was found to be filled with minute abscesses, the largest being about a half centimeter in diameter. There was considerable hemorrhage from the cut surface of the kidney, which was with difficulty controlled. As the patient's condition was critical, the kidney incision

was packed with gauze, and the external wound partly united and dressed. She died within twelve hours.

Then followed two other cases almost identical in onset, clinical history, and pathological findings. In both of these cases the kidney was explored, incised and drained. Both died within twenty-four hours.

Up to this time I feared to perform a nephrectomy for the reason that I believed the lesion to be bilateral, although the symptoms pointed to one side only. This view was strengthened by a striking case of bilateral hæmatogenous infection reported by Lilienthal, in which recovery followed a double nephrotomy.

The next case was, as will be seen, more carefully studied, and the treatment being the same, the autopsy gave me my first definite conception of the true pathological lesion, and clearly pointed to more rational and radical treatment.

CASE 2. The patient was a man, 21 years of age, who complained of general abdominal pain and frequent micturation, with hæmaturia. The symptoms temporarily subsided, but three weeks later the pain became localized over the right kidney region, and was accompanied by a gradually rising temperature and other symptoms of progressive sepsis. On examination, there were tenderness and some muscular rigidity in the right flank. The urine was albuminous, contained some pus, a few red cells and casts. Urine from the right kidney was scanty, highly albuminous, contained many red and a few white cells; that from the left practically normal. Temperature, 105.5° F.; leucocytes, 20,200. No evidence of other septic foci could be found. The right kidney was exposed by a lumbar incision, and freely opened by a cortical cut. The entire parenchyma was studded with minute abscesses. Drainage was inserted, and the wound partly closed. There was marked improvement in the symptoms, which continued for several days; but this improvement was succeeded by a gradual return of the septic manifestations, with scanty albuminous urine, delirium, and death.

On autopsy, the right kidney was found to be completely destroyed by numerous abscesses. The left kidney, spleen, and other organs showed the presence of very recent septic infarcts, which had not broken down. Cultures demonstrated *Streptococcus pyogenes*. In this case the lesion was evidently unilateral

at the time of the first operation, and had the kidney been removed at that time recovery would probably have occurred.

My first successful case was the following:

CASE 3. A woman, 28 years of age, experienced an attack of chills, fever, and general prostration, and was treated for malaria. An examination of the blood revealed no plasmodia, and upon subsequent examination a prolapsed and tender kidney was easily palpated. Urinary examination was negative. Under chloroform anæsthesia the kidney was explored and incised. The cortex was studded with small areas, the exact nature of which could not be determined at the time. The organ was removed, and on subsequent examination it was found to be the seat of numerous infarcts. The patient made a complete recovery.

The following case is of interest as illustrating how rapidly improvement may follow the removal of such a kidney, even under the most unfavorable conditions:

CASE 4. A female child, 3 years of age, was brought to the Vanderbilt Clinic, suffering from left-sided abdominal pain, high fever, and great bodily weakness. The temperature was found to be 103.8° F.; pulse, 130. An examination of the chest and abdomen was negative; slight tenderness in the costovertebral angle. Urine drawn by catheter was found to be albuminous, and contained a few pus cells. No vesical irritability, no other sign of local infection.

The patient was transferred to the Roosevelt Hospital, where it was discovered that the hands and feet were desquamating. Inquiry regarding exanthematous disease revealed the fact that she was supposed to have had measles four weeks before she was admitted. She was subsequently examined by Prof. A. Jacobi and an inspector from the Board of Health. Both pronounced the condition in all probability one of scarlatinal desquamation. The infant was removed to her home and quarantined. Five days later the mother came to the clinic and reported that the child had grown steadily worse and was apparently dying. The temperature had ranged between 103° F. and 105.5° F. during the week; the pulse from 130 to 160; the urine was scanty and cloudy; the child was thoroughly prostrated. Assisted by Dr. Turnure and Dr. Darrach of the Vanderbilt Clinic surgical staff, I did a hasty nephrectomy in the parents' home. The kidney was sur-

rounded by an œdematous fatty capsule; the organ was enlarged and highly congested; the fibrous capsule presented nothing abnormal, but on stripping it from the renal parenchyma the surface of the kidney was covered with deep violet, oval, and irregular lesions, which, upon section, contained bloody serum and granular-necrotic tissue. On section, the cut surfaces presented many similar lesions, as well as a number of triangular infarcts. Cultures taken from several lesions with the greatest care showed no growth after three days. The improvement in the child was marvelous. The temperature dropped several degrees within twelve hours, the pulse improved, and the infant made an uninterrupted recovery.

The following 2 cases illustrate how closely this condition may resemble acute appendicitis or inflammation of the gall bladder. In no less than six instances during the past two years the writer has known of a primary anterior incision being made in the belief that the symptoms were due to some intra-abdominal infection. In each instance no intra-abdominal lesion was found, the laparatomy wound was closed, and an acuely infected kidney discovered by a lumbar incision.

CASE 5. A woman, 22 years of age, experienced a severe pain in the epigastrium and right side of abdomen, with vomiting and high fever. She was sent to the Roosevelt Hospital with a diagnosis of acute appendicitis. On examination, the appendix region was free from evidences of inflammation. There was, however, pain and muscular rigidity in the right hypochondriac region, with tender points over the gall bladder and the costo-vertebral angle. Temperature, 105° F.; pulse, 120; leucocytes, 18,000.

Cystoscopic examination was negative; urine from the right kidney scanty and slightly albuminous, few pus and blood cells; that from the left kidney was abundant and apparently normal. Widal negative; no plasmodia; no tubercle bacilli in the urine. The diagnosis rested between an acute infection of the gall bladder or kidney, small anterior incision; gall bladder and liver found to be normal, but the right kidney seemed enlarged. Anterior incision united, and the kidney exposed by lumbar route. The perinephritic fatty tissue was œdematous; the kidney enlarged, highly congested, and the seat of innumerable small infarcts.

Nephrectomy was performed. After operation, the temperature fell from 105.5° F. to 97° F. within twelve hours, and thereafter remained practically normal.

She made a satisfactory convalescence. Microscopical examination of the specimen showed it to be filled with minute embolic abscesses.

One year later this patient married and became pregnant. I had an opportunity of examining her urine before and after her confinement. It was normal in every respect. Her confinement was normal, and she presented the picture of robust health two months later.

CASE 6. A young married woman was admitted to the Roosevelt Hospital, suffering from right-sided abdominal pain, high fever, and extreme nervous restlessness. Six weeks before she had an attack of supposed peritonitis from unknown cause. After recovery from this, she remained well until forty-eight hours before admission to the hospital, when she began to complain of pain in the region of the gall bladder, with vomiting, and a rapidly rising temperature. On admission the temperature was 105.8° F.; pulse, 140; respiration rapid and jerky. Examination of the chest was negative. On attempting to palpate the abdomen, the patient complained of such extreme tenderness and became so excited and hysterical that nothing could be elicited. (These symptoms were undoubtedly exaggerated by the presence of coexisting exophthalmic goitre.) The following morning the temperature had fallen to 102° F., but the pulse was extremely rapid and weak. Abdominal palpation revealed tenderness and marked muscular rigidity in the upper right quadrant, tenderness to pressure over the lower costal arches, and some pain on pressure over McBurney's point and in the costovertebral angle. Blood count showed 16,000 leucocytes, and 79% polynuclears. Urine was abundant, contained a trace of albumin and a few pus cells. She was immediately prepared for operation, the diagnosis resting between cholecystitis, subphrenic abscess, or abscess of the liver. An incision through the right rectus muscle revealed no intra-abdominal lesion, save a slight redness and œdema of the peritoneum overlying the right kidney. The anterior incision was closed, and the kidney exposed by a lumbar opening. The perirenal fat was œdematous, the kidney was highly congested, and

its cortex studded with dark red lesions. Nephrectomy, followed by an intravenous infusion of 1,500 cc. of normal salt solution. After removal, the kidney was bisected and found to be the seat of numerous infarcts and minute abscesses.

Cultures taken from a freshly opened abscess gave a growth resembling the colon bacillus, but on further investigation it was found to be a nonpathogenic organism, probably a contamination. The patient made an uninterrupted recovery, the temperature falling to normal immediately after operation.

I desire now to give an example of the severest type of the disease which has come under my observation. It also illustrates the disastrous results of delay. If she had been admitted to the hospital in the early stage of her disease, nephrectomy would undoubtedly have saved her life:

CASE 7. A woman, 31 years of age, was admitted to the Roosevelt Hospital in a condition of profound septic intoxication. She had had occasional attacks of abdominal pain, of short duration, for the past six months. Eleven days before admission she experienced severe pain in the right side of the abdomen and flank, extending upward to the chest; this was accompanied by chills, high fever, delirium, and great prostration. At the time of her admission to the hospital her temperature was 106.5° F.; pulse rapid and weak; leucocytes, 35,000. On palpation, the only sign that could be elicited was tenderness and muscular rigidity in the right kidney region. The urine contained albumin and a few pus cells. As her condition was extremely critical, she was immediately prepared for operation. On exposing the right kidney there was found a small focus of pus in the fatty capsule near the kidney cortex. The condition of the patient would not admit further exploration, and she was saved from death on the table only by an intravenous infusion of salt solution. The temperature rapidly rose to 112° F., and the patient died in a few hours. Autopsy revealed only multiple abscesses and infarcts of the right kidney. Cultures showed *Staphylococcus pyogenes aureus*.

Although numerous other examples of the severe type of the disease could be reported from my own experience or from those of my colleagues at the Roosevelt Hospital, I desire next to call attention to a few of the milder types in which measures less radical than nephrectomy may be successful.

CASE 8. A woman, 26 years of age, complained of severe right-sided abdominal pain, with nausea, headache, fever, and general prostration. Ten days later she was admitted to the Roosevelt Hospital; temperature, 102° F.; pulse, 120; leucocytes, 19,000, of which 81% were polynuclears. She complained of a bearing down sensation on urination. The following day the temperature rose to 104° F.; 82% polynuclears on differential count. The patient was then cystoscoped. The examination of the bladder negative; ureters were catheterized, and from the right there was a scanty flow of urine containing albumin, a few pus cells, and blood from the left, more abundant flow, few red cells, practically no pus.

Physical examination revealed tenderness in the right costovertebral angle. The kidney was not palpated. Left side free from tenderness. Operation was performed on the tenth day of illness. Right kidney exposed by lumbar incision; œdema of perirenal fat. Kidney was highly congested and presented six distinct cortical areas of induration. Each of these was opened and packed with separate strips of gauze tape, which were allowed to protrude through the partly closed parietal wound. Of the six lesions only one contained pus, the others necrotic tissue. The renal pelvis was opened; the mucous membrane appeared normal. Cultures made from the pus showed *bacillus coli communis*. The patient made a tardy but complete recovery.

The following case is of interest on account of the double lesion.

CASE 9. A female patient, 32 years of age, was sent in with diagnosis of acute appendicitis. The attack began by a severe right-sided abdominal pain, high fever, and prostration. There was marked muscular rigidity over the appendix and gall bladder regions, with tenderness both in front and in the costovertebral angle. In this instance the urinary analysis showed no red cells, only albumin and a few leucocytes. Temperature on admission was 102.4° F.; pulse, 120; leucocytes, 20,400. Although the temperature fell to 99.5° F. during the night, she was prepared for operation. An anterior incision was made, and the gall bladder and appendix found to be normal. This was closed and a lumbar cut revealed a large polycystic kidney studded with minute infarcts and small abscesses. As the toxic symptoms were already

beginning to subside in this case, and as there was a strong probability of there being a polycystic and possibly imperfectly functionating kidney on the opposite side, we punctured several of the large foci and stripped the fibrous capsule from the organ. She had a slow convalescence, complicated by an embolism of the third division of the right pulmonary artery. The recovery was, however, complete.

The next case, still more subacute, is of interest on account of the fact that the lesion resulted in complete absence of function.

CASE 10. It was that of a married woman, 23 years of age, who was admitted to the Roosevelt Hospital with a diagnosis of renal calculus. Seven weeks before admission she experienced a severe pain in the right loin, radiating to the groin and thigh. This pain continued for one to two hours and then subsided. Following the paroxysm of pain she had a severe chill, with fever and vomiting, which lasted for two days. During this period the temperature reached 103° F. Since the acute attack the patient had complained of more or less constant pain and discomfort in the region of the right kidney and ureter, with occasional attacks of a more acute nature.

On admission to the hospital she seemed weak and anæmic. Her temperature was 100° F.; pulse, 120; and the blood count showed 10,000 leucocytes, 56% polynuclears. Physical examination revealed tenderness in the right costovertebral angle, and along the course of the ureter to the pelvic brim. On cystoscopic examination the bladder appeared normal. There was no efflux from the right ureteral orifice, but an abundant flow from the left. Both ureters were catheterized. From the left there was an abundant flow of normal urine, from the right only a few drops were obtained after forty-five minutes. X-ray examination was negative. From these findings a diagnosis of subacute infarcts was made and an operation was advised.

Under ether anæsthesia, the right kidney was explored by a lumbar incision. The fatty capsule was somewhat thickened and adherent. The surface of the organ was studded with small, whitish areas which were moderately indurated. No calculus was felt. The fibrous capsule was stripped from the organ, the kidney replaced, and the wound sutured. There was a moderate febrile reaction following operation, which subsided on the seventh

day. The wound healed by primary union. All sutures were removed on the tenth day. Fourteen days after the operation she was again cystoscoped and the ureters catheterized. From both catheters there was an abundant flow, 12cc. from the right and 15 cc. from the left in twenty minutes. Although the urine from the right side showed a very faint trace of albumin, its percentage of urea was higher than that from the left, showing that its function had been practically restored.

To remind my readers that one may occasionally be mistaken regarding the virulence of a given case, I will relate the history of a patient whose symptoms and appearance seemed to warrant treatment less radical than nephrectomy.

CASE 11. A married woman, 30 years of age, had a severe chill, followed by high fever, prostration, and abdominal pain. When seen by her attending physician there was marked muscular rigidity and tenderness over the entire right half of the abdomen, the point of greatest tenderness being immediately over the middle of the ascending colon. When seen by the writer in consultation there was also found marked tenderness in the right costovertebral angle.

She was immediately transferred to the Roosevelt Hospital, where, upon examination, the urine was found to contain a trace of albumin, a few red blood corpuscles and pus cells. Temperature was 103° F.; pulse, 120.

On exploring the right kidney by a lumbar incision, it was found to be œdematous and highly congested. Two or three fair sized cortical abscesses were found and numerous smaller infarcts. The capsule was stripped from the kidney, the larger abscesses incised and packed with gauze, the wound partly closed, and an intravenous infusion of salt solution given. There was a marked temporary improvement in the symptoms. The temperature and pulse fell and she seemed brighter, but the pain continued and required morphine in considerable quantities for its relief. Two or three days later the temperature began to rise, the pulse increased in frequency, she became restless and delirious. We hesitated to remove the kidney on account of the uncertainty regarding the functional competence of the opposite organ.

Her sepsis continued to deepen, however, the tongue became dry and brown, the urine diminished in quantity, the delirium

increased, she became more and more prostrated. As it was evident that she would surely die unless the kidney was removed nephrectomy was hastily performed. The operation was associated with a considerable loss of blood from the slipping of a ligature on the renal pedicle. The loss was immediately made up by a large intravenous infusion of normal salt solution, which undoubtedly had a favorable effect on the profound toxæmia. The relief was striking, the pulse improved, the temperature gradually fell to the normal, the mind cleared, and convalescence was finally established. Although many months elapsed before she was completely restored to health, her recovery was in the end complete.

All of the foregoing cases have been examples of a more or less severe type of the disease which imperatively demanded some form of surgical intervention. I now desire to speak of the mildest type of the affection.

During the past eighteen months I have observed a number of cases presenting symptoms practically identical with the preceding, but much milder in character, all of which under expectant treatment went on to a presumably complete recovery. I will give but three examples.

CASE 12. A young lady, 25 years of age, experienced an attack of right-sided abdominal pain, with fever, vomiting, tenderness, and muscular rigidity over the right lower quadrant. These symptoms had been preceded by a subacute attack of follicular tonsillitis. Her attending physician regarded the case as one of appendicitis, and asked me to see her in consultation with a view to operation. At the time of my visit the temperature was 100° F., pulse 110. There was a slight tenderness over McBurney's point, which extended upward nearly to the costal border. The muscles were moderately rigid. There was marked tenderness in the costovertebral angle. As no urinary analysis had been made I declined to operate upon her on the ground that in my opinion the lesion was a unilateral hæmatogenous renal infection. I ordered an examination of the urine, and predicted that a trace of albumin would be found, a few red cells, and pus, if the specimen was precipitated by the centrifuge. The analysis proved this prediction to be correct. The patient made a satisfactory recovery without operative treatment.

CASE 13. A young man, 23 years of age, was operated upon by me for an acute streptococcus appendicitis with spreading peritonitis. Although quite septic at the time of operation he made a satisfactory convalescence. About the sixth day after operation, when the temperature had fallen to the normal, he experienced an acute stabbing pain over the lower ribs on the left side, with a sharp rise of temperature. I regarded the case as one of acute pleurisy, but on physical examination was surprised to find no definite signs in the chest. I called an expert medical consultant, who also was unable to find evidences of plural infection. We were at a loss to account for the pain and fever which continued for two or three days, when a urinary analysis showed a trace of albumin and a small number of pus and red cells. Subsequent examination revealed the characteristic costovertebral tenderness, and daily examination of the urine showed the unmistakable evidences of renal infection. The symptoms persisted for ten days or two weeks, but were never severe enough to warrant operative interference.

At the same time another patient in the hospital, after an operation for the removal of the appendix, experienced an identical attack. This case was subsequently seen by Dr. Klotz, who by cystoscopic examination and an examination of the separated urines, was able to confirm our diagnosis. She made a tardy though complete recovery.

The chronic forms of this disease are not infrequently encountered, and furnish an interesting group for further study, but the limits of this communication will not permit me to consider these at this time.

In conclusion, permit me to say a few words regarding diagnosis and treatment.

*Diagnosis.*—The disease may or may not be ushered in by a chill. When present it generally indicates a severe type of infection. The initial rise of temperature is high, generally 104° F. or 105° F., the pulse is frequently 120, or above. The toxæmia is marked from the first, and with the high fever suggests often an acute grip, lobar pneumonia, or one of the exanthemata. Then follows a more or less vague pain in the abdomen or flank corresponding to the side of the lesion. Tenderness and muscular rigidity over the region of the appendix or gall bladder leads often

to error in believing one of these organs to be the seat of disease. As the urinary secretion from the infected kidney is greatly diminished and is largely diluted by the abundant secretion from the unaffected organ the mixed urine when passed or drawn from the bladder is often quite normal in appearance, and the slight trace of albumin, blood, and pus is often overlooked unless a more than ordinarily careful examination is made.

The one pathognomonic sign present in all cases is a marked unilateral costovertebral tenderness.

*Treatment.*—In regard to treatment, the cases should be divided into three classes.

The severe type, in which the temperature remains high, and the toxæmia is rapidly progressive. These cases require nephrectomy at the earliest possible moment.

The milder cases are those in which the initial temperature may be high, but begins to fall within forty-eight hours, and where the toxæmia is less marked. These cases may often be successfully treated by decapsulation, which relieves the intense congestion and allows Nature to complete the reparative process. Where one or more cortical abscesses are present they should be opened and drained.

In the mildest type, the case may be treated expectantly with a reasonable prospect of complete recovery, although the writer has observed two or three patients in which a chronic pyelonephritis has remained.

*Statistics.*—The following are my own statistics to date: Nephrotomy and drainage in five patients of the severe type, all died. Nephrectomy in eight patients of the severe type, all recovered. Nephrectomy decapsulation and drainage in five patients of the milder type, all recovered. Expectant treatment in four or more patients of the mildest type, all recovered.

# EXPLORATION AND DECAPSULATION OF THE OTHER KIDNEY BEFORE COMPLETING A NEPHRECTOMY

By GEORGE M. EDEBOHLS, M. D., of New York

IN recent years an enormous amount of painstaking scientific investigation and persistent, praiseworthy effort have been expended on the part of such masters as Koranyi, Kummell, Casper, Israel, Rovsing, their assistants, and many others, with a view to finding and elaborating a reliable method of determining the functional activity or possibilities of each kidney separately, or of both kidneys combined, in advance of a contemplated or possible nephrectomy. The result of all this investigation and effort has been to add one after another to the already long and still growing list of so-called functional tests. Yet despite the fact that every recent writer on the subject, with or without personal experience in the matter, feels himself called on to discuss at greater or less length all and sundry of the various functional tests of which he may have heard or read, it cannot be said that anything even approaching a consensus of opinion has been reached. On the contrary, so far from this being the case, we find the masters themselves at sea and divided in the matter. Some of them, while strenuously upholding the utility of this or that method favorite with himself, deny all or much practical value to the methods employed by their confrères. Others, like Israel and Rovsing, for example, deny all practical value to any of the modern functional tests, the latter falling back on the only method that has, to a certain extent, stood the test of time and experience, namely, the determination of the daily output of urea. Yet, in spite of the apparently discouraging present situation, the hope appears to be justified that the prodigious efforts put forth in the attempts to solve the problem will not have been expended in vain, but will result in giving us, at an early date, a practical, satisfactory, and generally acceptable method of determining the amount of work which we can count on any given kidney to perform.

Such knowledge is especially needed and becomes of vital importance on the eve of a contemplated nephrectomy. Is there

a second kidney and, if so, is it in condition to take up and to carry on unaided, to the full extent required, the elimination of poisonous waste products which can pass out of the system only through the kidneys, and a failure to eliminate which puts an end to life?

In the present state of our science and art, the method of procedure introduced by me several years prior to the advent of the modern functional tests, still constitutes our main reliance and ultimate resource. This method, which I first practiced in 1894 and advocated in a paper [1] on "The Other Kidney in Contemplated Nephrectomy," consists in exposing and examining, through a second lumbar incision, the fellow kidney before completing an otherwise indicated nephrectomy.

The routine procedure which I have practiced in all my nephrectomies for the past ten years or more, consists in first cutting down on and thoroughly exploring the kidney that may require removal. A vital and essential part of such exploration consists in not disturbing in any way the vital connections of the organ at its root, the renal vessels and ureter. Should such exploration of the kidney confirm the necessity and indication for its removal, the kidney is for the present replaced and a second lumbar incision, for exploration of the other kidney, is made on the opposite side of the body. If the second kidney be found in good condition, or in condition sufficiently good to sustain life, it is replaced and the second wound is closed. Returning now to the first incision, the diseased kidney is delivered and removed. Should exploration, on the other hand, show advanced disease of the second kidney, or that nothing would be gained by the removal of either kidney, then both kidneys are replaced in the body, either closing both wounds or treating either or both kidneys by such conservative measures—decapsulation, nephrotomy, resection, drainage, etc.—as may be indicated under the circumstances.

This method of procedure in nephrectomy was, as above pointed out, first practiced and published by me, although Rovsing [2] mistakenly claims priority in the matter more than six years after my publication. Rovsing bases his claim on an operation performed by him in 1894. In this case, one of renal hæmaturia,

[1] *Ann. of Surgery*, 1898, xxvii, 425–435.
[2] *Arch. f. klin. Chir.*, 1904–5, lxxv, 867-895.

the healthy right kidney was first cut down on as the result of a mistake in diagnosis, necessitating a second incision for removal of the diseased left kidney. The original error of diagnosis, therefore, necessitated the second operation, quite a different matter from an operation of selection performed on the second kidney with a view to determining whether the kidney first exposed can be safely removed. Nor do any of Rovsing's writings between 1894 and 1904, although many of them deal with nephrectomy as such and detail cases of nephrectomy at great length, contain any mention whatsoever of the procedure under discussion.

The second lumbar incision for exploration of the other kidney has three distinct purposes. In the first place, it gives absolutely positive information as to the existence or non-existence of a second kidney; in the next place, it enables the surgeon to determine the condition of that kidney; and lastly, it places him in a position to decapsulate the remaining kidney. The advantages of the latter procedure will be considered later.

The existence of a second kidney is of vital importance in nephrectomy. A number of cases are on record in which a patient's only kidney was removed, with the inevitable result. In addition to the recorded cases, a number of unpublished cases may be assumed to exist; I have personal knowledge of at least three such. And it must be stated emphatically that no method of examination at our command, short of exploratory incision, can give absolute and indisputable certainty of the existence of the two kidneys. Even catheterization of both ureters may deceive us on this point, as illustrated in the case presently to be related.

I have operated in all on three patients possessing, as determined by cutting exploration, but one kidney each. In two of the cases, the operation contemplated was not nephrectomy, and these two patients were therefore safe from the possible disaster of removal of their only kidney. Not so with the third patient, whose life was spared by virtue of the second exploratory incision, and whose story I will briefly outline:

CASE. N. J., a married woman aged 35, came under my care in November, 1902, with pyuria, febrile attacks and a tumor in the right flank diagnosed as hydronephrosis affecting a movable right kidney. Cystoscopy showed two ureteral orifices pre-

senting no marked differences in appearance. On account of the pyuria, catheterization of the ureters was not performed at this examination, from dread of possibly infecting the presumably healthy left kidney.

Fixation of the loose hydronephrotic right kidney, performed on November 10, 1902, afforded but temporary relief. Nephrotomy was next tried on January 5, 1903; a large quantity of pus was evacuated and continued drainage was established. About 720 cc. of urine drained away daily through the lumbar wound, while about 480 cc. were passed daily *per urethram*. The latter amount was assumed—incorrectly, as was proven later—to come from the left kidney.

With the closing of the wound the old symptoms returned and, with the concurrence of a consultant, nephrectomy was considered indicated and was attempted on January 19, 1903. The right kidney was fully exposed and freed from its connections except at the root, where the renal vessels and ureter were left intact. The kidney being temporarily replaced, a second incision was made over the left lumbar region. Search high and low, the peritoneum being freely opened to facilitate such search, failed to find a second kidney. The left wound was closed and the right kidney was freely incised for drainage, which was maintained for some six weeks, at the end of which time the wound closed spontaneously and permanently. With the exception of a very moderate amount of pus in the urine the patient is well to-day, more than four years after the operation.

The existence of two ureteral orifices with but one kidney seemed to call for explanation and certainly piqued curiosity. Catheterization of both ureters was performed some time after the operation when the patient was again up and about. The right catheter passed freely up the right ureter to the kidney and yielded urine identical in composition with that obtained from the bladder. The left ureter was pervious to the catheter for some 20 cm. at which point the further progress of the instrument was arrested. Not a drop of urine came from the catheter, although the latter was allowed to remain some twenty minutes.

The case, therefore, was one of absence of the left kidney and the upper end of the left ureter, with presence of 20 cm. of the bladder end of the left ureter. Were the absence of the left

kidney not established beyond question, arrest of the ureteral catheter at 20 cm. from the bladder might be mistakenly interpreted as due to stricture of the ureter at that point, and not as demonstrating the absence of the corresponding kidney. In a similar manner, catheterization of both ureters in a case of solitary kidney with two ureters would fail to demonstrate the absence of one kidney. For any surgeon, therefore, depending on any and all means, short of direct cutting exploration, for determining the presence of two kidneys, the fatal mistake of removing a patient's only kidney is still among the possibilities.

Inspection and palpation, aided on rare occasions by exploratory puncture, of a kidney at the bottom of an incision, or, better still, when delivered into the wound, will enable all but the veriest tyro to determine the presence or absence of gross lesions, such as tuberculosis, abscesses, stones, and tumors. If both kidneys be found affected with tuberculosis, advanced purulent degeneration, or tumor, nothing will be gained by removing either kidney, and a nephrectomy possibly contemplated at the beginning of an operation should be abandoned. If stones be found in both kidneys, it is usually the best procedure to remove the stones from both organs, draining or not as may be indicated.

A different situation arises when it comes to the recognition of the finer structural changes which may affect a kidney. But even here it is, for the purposes of the surgeon, mainly a question of the extent and degree of such changes, and these, I maintain, can be readily appreciated after some experience in the examination of kidneys during life. It is not difficult—nay, it is very easy—to recognize advanced fatty and waxy degenerations, interstitial and other varieties of nephritis without the requirements demanded by the pathologist of splitting the kidney from end to end and through its entire thickness. If aid akin to this be needed, the surgeon may remove a small piece of kidney tissue, examination of a frozen section of which can be made on the spot in a few minutes by a competent pathologist. Pending the decision of the pathologist, the surgeon may occupy himself with attention to necessary details of operation. Generally, however, if not always, the surgeon of sufficient experience in gross pathology will be able to decide from macro-

scopic appearances alone whether or not a given kidney is in sufficiently good condition to take up the burden imposed on it by the removal of its fellow.

Two good and sufficient reasons for exploration of the other kidney in contemplated nephrectomy have been advanced and discussed. A third reason or indication for exposure of the remaining kidney in nephrectomy has, within a more recent period, arisen in my practice. I refer to decapsulation of the remaining kidney for the purpose of preventing or lessening the liability to death from renal insufficiency, the so-called renal death. As one result of my work in the surgical treatment of nephritis, I have learned that two effects of renal decapsulation may be regarded as practically invariable and constant. First, renal decapsulation invariably and at once increases the daily urea output of the kidney or kidneys; and second, renal decapsulation enables any kidney to do the best work possible for that particular kidney to perform. Both these results act directly to prevent a renal death. And, as a matter of fact, I have had no renal deaths in my nephrectomies of the past seven years, during which I have consistently practiced decapsulation of the remaining kidney.

There can be but two possible objections advanced to the routine practice of exploration and decapsulation of the remaining kidney when performing nephrectomy, on objection partly including the other. These are increased risk to life and undue length of time required for operation. As regards increased risk to life, the objection is not valid; for it is to prevent deaths due to absence of a second kidney, due to want of knowledge of its condition, and due to its inability to take up the burden of excretion necessary to maintain life, that exploration and decapsulation of the remaining kidney are advocated.

Operations on both kidneys at one sitting are no longer uncommon. My personal experience in renal surgery embraces 688 operations performed on one or both kidneys of 460 patients. In 232 of these patients only one kidney was operated on; in 228 patients operation was performed on both kidneys at one and the same sitting. In the earlier years of my surgical career simultaneous operation on both kidneys was the exception; in later years it has become almost the rule.

With good technic and proper posturing and handling of the patient during operation, exploration and decapsulation of the remaining kidney should not add more than from ten to twenty minutes to the time required for a nephrectomy. The disadvantages of a slightly prolonged operation are more than counterbalanced by the vital advantages gained for the patient in other directions.

In conclusion, and based on the foregoing, I would respectfully advance the proposition that no nephrectomy should be completed without examination and decapsulation of the remaining kidney.

## DISCUSSION OF PAPERS PRESENTED AT THE JOINT SESSION

Dr. E. W. CALDWELL, of New York, showed several skiagraphs illustrating stereoscopic methods and the use of the styletted ureteral catheter for differentiating calcareous bodies within the urinary tract from those lying outside of it.

With most of Dr. Cole's conclusions, he was in accord but he wished to express dissenting views respecting one or two of them. He believed with Dr. Cole and Dr. Brewer, that the X-ray was more accurate than any other single method of diagnosis of urinary calculi. However, he did not think it infallible in cases presenting the combination of calculi composed entirely of pure uric acid in subjects who were extremely unfavorable for X-ray examination. In most of the cases in which the X-ray indicated that no calculus was present there was no operation and no positive demonstration of the accuracy of such indication. All statements as to the accuracy of the X-ray indication of "no calculus" must therefore be regarded as more or less speculative and not as accurate scientific data. He believed, however, that few errors were made with competent examinations such as were evidenced by the excellent work Dr. Cole had shown.

Referring to the expressions "Secondary Ray," "Ray of Selective Absorption," "Direct and Indirect Rays," he wished to make criticisms. The discovery of the secondary rays was not a recent one, but was commonly credited to Röntgen who described them and gave them this name in his classical third paper, published in 1897. The term was descriptive, it had come into general use and was therefore thoroughly acceptable. Objection was made to the use of the expressions "Ray of Selective Absorption," "Di-

rect and Indirect Rays," because they were not sufficiently descriptive and because they implied the recent discovery of phenomena which also had long been well known. Appliances for cutting off the so-called indirect rays had been in use and were described by Rollins and others as early as 1898. The best known of these appliances, the compression diaphragm of Albers Schonberg, with which many of Dr. Cole's beautiful plates were made, had been in the market, and its purpose fully explained before the tentative "Ray of Selective Absorption" was proposed. He therefore thought it was unfortunate to use such expressions at this time, although he confessed the need for suitable additions to the terminology of the subject.

Dr. HOWARD A. KELLY, of Baltimore, said he wished to ask whether there was any secret whatever about any part of this matter from beginning to end. There was an impression that there were some parts of the process which our friends, the X-ray specialists, would not tell to the rest of the profession. One undoubted difficulty in X-ray work is that it is impossible to get first-class men in this class of work in all parts of the country.

Dr. COLE, replying to Dr. Kelly's question, said there was absolutely no secret about the making of these skiagraphs. Dr. Kelly, who is world renowned for his attention to minutest details, and who has just read such a valuable paper on mensuration of the bladder, should know that the secret of success in Skiagraphy, as in any other branch of medicine or surgery, lies in the attention given to the minutest details from the catharsis of the patient, to the reading of the finished negative.

Dr. L. BOLTON BANGS, of New York, said he wished to contribute a word or two from the clinician's standpoint. It went without saying that this was an exceedingly interesting discussion to him. The contributions in these various papers spoke for themselves. He would like to know about one or two points only. One of them was a very small point, was one which he did not understand, and yet, from the clinician's standpoint, it was of some consequence, because of the pain which he was certain they had caused the patients who were subject to them. That was the presence of these so-called "phleboliths." He confessed that when he had found them, irrespective of any relation to the kidney symptoms, and therefore without any relation to radiographs, he had been puzzled as to their exact situation, and as to what he should do for them. He wished to know what they were and what to do for them. To those engaged in genito-urinary work ureteral stones were comparatively common. The diagnosis had been made much easier since the introduction of the X-ray, and surgical procedures instituted for the relief oft he patients, but there were some cases, where one would think a surgical

procedure was necessary, but where relief could be obtained by comparatively simple measures. He referred to certain stones in the lower end of the ureter. He mentioned a case that recently came into his experience. The stone was triangular in shape, had roughened surfaces, and the longest side of the triangle was nearly half an inch. It was thought at first that it would be necessary to open the abdomen in order to remove the stone, but by means of an instrument in the bladder and manipulation through the rectum the stone was dislodged. Judging from the symptoms, the stone had apparently been in place for at least a year. He was encouraged to attempt this by his experience in a case where, by successive radiographs, he had been able to trace a stone from the kidney down to the ureteral mouth, and finally to secure its dislodgment. Therefore, he was all the more confident in making the attempt before proceeding to a prolonged surgical procedure, and it proved successful. He wished to call attention to a point suggested by Dr. Brewer's paper, that most of his cases were in women. He would like his gynecological friends to explain that fact. He had noticed it before. He mentioned a case which he had seen in a man, who had distressing vesical symptoms. He certainly had an attack of so-called grippe, with all the symptoms of that disease. There was a rise of temperature at the onset to 104. When Dr. Bangs was summoned in consultation on the case he was convinced that the patient had a pus kidney. He was not prepared to say it was the condition which Dr. Brewer had described. His pain was abdominal, on the left side, where there were rigidity of the muscles and tenderness on palpation. Cystoscopy revealed a hazy, purulent urine, coming from the left ureter. An exploratory operation was refused. The patient had another rise of temperature, but not so high as the first, and pain on the right side. Twenty-four hours afterwards he complained of colic on the right side, and there was a sudden escape of two drams of clear pus, by way of the urethra. That was a complication which disturbed the diagnosis. The patient refused all operative procedures, and gradually got well.

Dr. F. TILDEN BROWN, of New York, said that Dr. Huntington's description of, and anatomical reasons for, the so-called tandem kidney would lead us to see how ineffectual the cystoscope would be in such cases, if there were any pathological conditions connected with these kidneys. Cystoscopy would show the ureteral mouths in normal positions. If we passed a ureteral catheter into each ureter and got normal urine, we would have no idea whatever of the fact that both kidneys were one kidney, or that they were atypical in their relations to one another—that they were unilateral. Whereas, by the employment of this added device, to which reference had been made by several of

the speakers, the stylet in the ureter catheter, we would have at once an evidence of the anatomical conditions existing, and by that means only would we have a clear idea in case there was a pathological condition in one of these kidneys, or one part of this merged kidney. If after passing the catheters into these normally placed ureters, we drew purulent urine from one of them, we would be led astray, unless we employed the styletted catheter. Dr. Brown said he wished to make a plea for the more extensive employment by genito-urinary surgeons of both of these resources, and he thought it well to make use of them at one and the same time. He said he had a table so constructed that it was suitable for cystoscopy and ureter catheterization. If for any reason it was thought necessary to make a further examination, it could be done without disturbing the patient. The catheters were left in place, stylets introduced, and X-ray plates made to determine the positions of the ureters and kidneys. Dr. Brown here showed plates made in a case of double ureter, where the condition was verified, and the lengths of the ureters and their points of entrance into the kidney determined by this means. There were pathological conditions in this case, and after many consultations and much consideration he was in favor of deferring operation, because he believed that a partial operation and removal of the lower portion of this kidney having the double ureter would not be very feasible, or it would be attended with so much trauma as to necessitate a complete nephrectomy, which the patient's condition hardly justified. One shadow was heavier than the other, as a heavier stylet was put in one ureter than in the other, so that, in case they crossed each other, it would be possible to identify them. There were several other points in this connection. Here was a case in which it was almost impossible to determine the nature of a large, loose-lying tumor in the pelvis, and the ureter catheters apparently passed to the same length, and one drew urine and the other resulted in nothing coming from it. As to the diagnosis of stone by X-ray, Dr. Brown said he would like to say that he was, despite the wonderful advances in X-ray work and the leading exponents of this X-ray work that we had in New York—and it was hardly necessary for him to mention by name Dr. Cole and Dr. Caldwell, whose work was on a par with that of any in this country—despite all this, he could not agree with the first speaker (Dr. Cole) in his maintenance of the fact that a negative diagnosis could be made by the X-ray alone, no matter how completely it was carried out. Dr. Cole had done a greal deal of work for him, and he had the highest regard for it, but he could not agree with him that stones of all kinds could be determined by even the excellence of his work and technique.

Dr. E. B. Cragin, of New York, said he wanted to say just a word in

answer to the question asked by Dr. Bangs as to the greater frequency of kidney infections in women than in men, especially in women who had been pregnant. The position of the uterus in the right oblique diameter of the pelvis obstructs, to a greater or less degree, the flow of urine from the right kidney, making the right urinary passage more vulnerable and infection more frequent. The same thing would apply in a comparison of the frequency of infection in men and women.

Dr. FRANCIS R. HAGNER, of Washington, D. C., said he would like to report a case and present a specimen in connection with Dr. Chetwood's paper. This was a case of calculus with pyonephrosis, that showed the importance of considering the question of calculus even when only bladder symptoms were present. The patient was a male, 39 years of age. When he was 17 years of age he was refused life insurance on account of pyuria. He had had no illness except diphtheria at 16. Had never had renal colic nor any symptom referable to the kidney. Had complained of frequency of urination since he was 17 years of age, and had all the symptoms of bladder irritation. At times there was great pain in the bladder and it was thought to be due to a cystitis. His bladder was washed out for five years. His surgeon thought he had tuberculosis. Physical examination revealed a tumor in the right kidney region. On May 24, 1906, about one year ago, he was cystoscoped. The bladder appeared normal, except for reddening and eversion of the right ureteral opening. The urine from the left ureter was normal. Whitish, worm-like casts were seen passing from the other ureter. X-ray examination was negative. An extra-peritoneal lumbar operation was done, the kidney being removed, which was found to contain at least one pint of pus, three large stones, and thirty or more small ones. The patient made an uninterrupted recovery and now, one year after the operation, he is 36 pounds heavier. He was astonished that his kidney was affected, and could not believe it, as he had never had any pain or tenderness on palpation in the kidney region. Dr. Hagner said he reported this case to show what severe lesions might be present in the kidney without showing pain, tenderness, or any symptom referable to the kidney itself.

Dr. HOWARD A. KELLY, of Baltimore, said that he wished to say a few words in reference to the transvesical collection of urine from one kidney while the other was catheterized. He had found this procedure of the utmost service; *e. g.*, given a kidney which was almost certainly bad, and in all probability must be operated on, while the condition of opposite kindey is doubtful. A large ureteral catheter, large enough to plug the ureter, is passed on the diseased side, and the bladder is then carefully washed out until the wash-

ings return clear. While the urine is being collected by the renal catheter from the diseased side, the urine from the other kidney is being excreted in the bladder. When sufficient time has elapsed this urine, which represents the kidney fairly well, is drawn out of the bladder. If the urine is clear of pus and bacteria, then it is certain that the kidney is normal. If the bladder is severely diseased, this method does not give evidence as to the soundness of the non-catheterized kidney; its functional activity, however, can be estimated, and in this way it is possible to avoid inserting a renal catheter which has passed through a badly infected bladder into a sound kidney.

Another method which he has employed in a great many cases and found of immense value is the measuring of the capacity of dilated pelves and thus accurately grading hydro- and pyonephrosis. The ureter is catheterized with a large catheter and the amount of urine obtained in a given time noted. The kidney is then injected with a sterile salt solution colored with methylene blue until pain in produced. The amount injected is accurately noted. In this way very early hydronephroses can be determined, and the results of treatment estimated. Dr. Kelly regretted that the limited time allowed him did not permit his going into detail in regard to this method.

Dr. LAPTHORN SMITH, of Montreal, said a woman was sent to him with what was thought to be a large ovarian cyst. He operated on her, through the abdomen, and at once saw that it was a kidney. He took out about a gallon of purulent fluid, and then found a number of large calculi imbedded in the pelvis of the kidney, which rendered the latter too big to be removed through an ordinary incision in the loin. It was easily removed by the abdomen, and the woman made a good recovery, except for one very remarkable symptom. She had a pulse of 120 for a month after the operation. This symptom gradually disappeared, however, without any bad effects. In reply to the question as to why women were more liable to these troubles than men, he thought there were two reasons. One was their greater liability to tuberculosis, and the other their greater confinement to the house than men, predisposing them to the uric acid diathesis and rheumatic troubles generally.

Dr. COLE, replying to Dr. Caldwell's statement, regarding the nomenclature and the use of the terms direct and indirect rays, would simply say that he had worked along this line and came to these conclusions, and after coming to these conclusions he had called the rays by these names as best describing them. He knew of no such work having been done previously. Not reading German, he had asked men who should have known if work had been done along these lines. It appeared to be new and he therefore published it as such. If the separation of the rays had been described before, its im-

portance was not recognized, as Dr. Caldwell, in his book published about that time, mentioned the secondary or Sagnyac rays and also mentioned a ray called by the French parasitic ray, but did not recognize either as particularly detrimental, and even now the difference between the secondary or Sagnyac ray and the so-called indirect ray generated at the wall of the tube by the deflected cathode stream, was not generally recognized. Whether the indirect ray was new or old, or whether it had been described before or not, was not so important, as the fact that the majority of physicians doing this work had not recognized it as the most important cause of failure in skiagraphy, and that the elimination of it gave the results shown this morning by Dr. Caldwell and himself.

Dr. CHETWOOD said it would be absolutely impossible for him, after such a brief description of cases, to draw up proper conclusions, or to summarize in a satisfactory manner. He would have liked to draw attention to some of the omissions, defects, and errors, in the working up of these cases, to emphasize the great importance of the preliminary work and having recourse to all means of diagnosis, laboratory, X-ray, cystoscope, etc. Finally, he would like to give due credit for the admirable and beautiful mounting of the specimens to Dr. Frederick Sondern of New York.

Dr. EDEBOHLS, in reply to the question as to why kidney troubles were more common in women than in men, said that in addition to the reasons assigned by previous speakers, movable kidneys were more common in women, and therefore, as movable kidneys were more liable to traumatism and disease than kidneys in place, women were more subject to disease of the kidney than men.

# Theses Presented by Candidates for Admission to the American Association of Genito-Urinary Surgeons, 1906

## GONORRHŒAL PROSTATITIS

By J. Bayard Clark, M. D., of New York

THE constancy with which prostatitis occurs when gonorrhœa invades the posterior urethra, and the persistent nature of that inflammation after the subjective symptoms, and the more evident of the objective symptoms, have subsided, give this condition the right to more consideration.

That a gonorrhœal inflammation of the posterior urethra ever occurs without involving the prostatic ducts to a greater or less degree seems unlikely. Anatomically, there is little to invite a posterior urethritis to the exclusion of the prostate. The character of the epithelia, the scarcity of mucous glands, and the almost vertical direction of the canal, which is distended so much of the time with urine and made one with the bladder cavity, are factors against a theory that the prostatic urethra can be affected with a gonorrhœal infection without the prostate participating.

Acute gonorrhœal prostatitis—the division of this affection into the catarrhal, the follicular, and the parenchymatous forms—may well be accepted as expressing the clinical varieties, providing the tendency of one form to merge into another is appreciated.

### CATARRHAL PROSTATITIS

This form is by far the most frequent of the acute varieties. It is highly probable that with every posterior gonorrhœa there is some involvement of the prostate and though it may extend but a short distance into the prostatic ducts and be relatively mild, it is obvious that its existence should be appreciated.

The symptoms of catarrhal prostatitis go hand in hand with the symptoms of posterior urethritis—the increased desire to urinate, the cloudiness of both portions of urine, and the characteristic small, round and comma-shaped shreds which so often appear. These filaments, when examined microscopically, are usually small plugs or casts made up of mucus, pus cells, cuboidal and cylindrical epithelia, and gonococci. The prostatic origin of these shreds is not difficult to prove. If after a portion of the urine is voided light digital pressure is made on the prostate, the shreds are squeezed into the urethra and carried out with the urine which is then passed.

The danger of manipulating the prostate during an acute inflammation of that organ is ever to be borne in mind on account of its tendency to produce not only an acute epididymitis, but an extension of the prostatic involvement as well. The clearing up of the acute posterior urethritis is, I believe, seldom accompanied with a resolution of the catarrhal prostatitis. Its tendency is to go on to a chronic condition.

The diagnosis must usually be made by the urine, as examination of the gland by the rectum frequently fails to show any change in size or consistence or give any areas of tenderness.

### FOLLICULAR PROSTATITIS

This may be an extension of the catarrhal form or it may follow directly the onset of an acute urethritis posterior. The process of inflammation extends in a selective way along certain ducts toward the periphery of the gland, and usually in its upper part, there to establish, by purulent or cystic distension of the alveoli, the small nodules or tender areas detected by digital examination. The symptoms accompanying this phase of acute prostatitis are not unlike those of the previous variety—increased

and usually painful urination, the pain intensified at the close of the act; both urines cloudy; and the comma-shaped shreds, which are seldom absent.

Follicular prostatitis, like the catarrhal, tends to become chronic. The treatment during the acute stage consists in the treatment of the urethritis, by the avoidance of bodily exercise, by the avoidance of local manipulation of the prostate, and by the avoidance of constipation, and the institution of such measures as will tend to reduce the existing congestion and inflammation.

### PARENCHYMATOUS PROSTATITIS

In its milder forms this is clinically identified by the hyperemia or congestion of the entire gland. By the rectum the prostate is felt to be evenly swollen and smooth, and its consistence is elastic or edematous, though, from time to time, only one of the lateral lobes is found thus affected.

Although the organ is distinctly sensitive to pressure there is no sharp pain, but the patient experiences a sense of fullness in the perineum. Urination is made more difficult and painful and defecation is attended with pain and discomfort. There is no fever. The condition under appropriate treatment may subside in a few days and all subjective symptoms disappear, or it may go on to chronic prostatitis or take on the progressive course which we recognize as the severer form of parenchymatous prostatitis, and which at times ends in abscess formation. Here we find a patient suffering with a painful sense of pressure and swelling in the perineum and rectum. Micturition usually becomes difficult and painful, though in some cases this is absent, while in other cases there is complete retention. Pain may radiate to the glans penis, to the thighs, or across the back. Defecation may be very painful and erections and pollutions distressing. Fever may be present and accompanied by chills, though Casper had 21 cases which went on to prostatic abscess, and among them only 4 had a rise of temperature. On palpation the neighboring parts are found extremely sensitive, while the rectal examination of the prostate is exquisitely painful.

The gland is found swollen to twice or four times its normal

size. It feels hot and is hard and tense, being sharply defined against the surrounding softer structures. Its surface is smooth, seldom irregular, and one side only may be affected.

Notwithstanding the severity of the process, it may not go on to abscess formation, but, in from one to two weeks, the symptoms may subside and resolution take place. This, fortunately, occurs in the larger proportion of cases, which then go on to a chronic condition.

When suppuration does occur, the clinical picture usually becomes intensified. The pain on urination is increased, ischuria is common, and the prostate becomes a pulsating and painful tumor. Rectal tenesmus is constant. The temperature rises, the tongue becomes dry, thirst is intense, and the appetite gone; headache and backache ensue. Thrombosis of the periprostatic venous plexus, or in the prostatic veins themselves, may take place and go on to a typical occurrence of pyemia. It is usually not difficult to detect suppuration n the inflamed prostate.

Surgical interference is at this moment demanded. If it is delayed, the abscess usually empties itself, and most commonly into the urethra. The urine then becomes loaded with the products of suppuration, and the fever, the dysuria, and the rectal tenesmus rapidly subside. It may be that the evacuation of pus is incomplete, and in this instance the disappearance of symptoms is delayed and the process may proceed to a chronic condition. Complications, such as infiltration of urine, gangrene, chronic septicemia, or fistula, at times ensue.

Next in frequency to the urethra as an exit for the pus, come the rectum and the perineum in the order given. In Segond's collection of 102 cases, perforation occurred 64 times into the urethra, 43 times into the rectum, 15 times into the perineum, 8 times into the ischiorectal space, 3 times in the inguinal region, twice through the obturator foramen and once each through the navel, through the ischiatic foramen, at the border of a false rib, into the abdominal cavity, and into the space of Retzius. The after-results of prostatic abscess may be chronic suppuration, neurasthenia, impotentia generandi, stricture of the rectum, etc. It is to be borne in mind that besides the complications which not infrequently attend suppurative prostatitis the mortality is considerable. In the 102 cases of Segond's referred to above,

there was a 34% death rate. This is, however, considered very much too high according to other observers.

The treatment of these severer forms of parenchymatous prostatitis is both general and local. The patient should be put to bed, a light diet given and the lower bowel kept empty. Urinary antiseptics should be given and warm applications or sitz baths prescribed. Early in the process the direct application of cold to the prostate by means of one of the instruments designed for that purpose is often apparently of great benefit. The severer pain and dysuria must be controlled by opium or its alkaloids. A complete retention of urine demands catheterization. With the breaking down of the process into abscess formation comes the necessity for surgical relief.

## CHRONIC PROSTATITIS

This condition assumes a degree of importance which the acute varieties cannot approach. On the score of infectiousness acute prostatitis is little to be feared, as the active and painful nature of the condition renders the individual practically incapable of sexual intercourse. On the other hand, chronic prostatitis, which is so often wholly devoid of subjective symptoms, is probably a fertile source of the infection of women. In this connection it is to be especially noted that the great majority if not all of the acute inflammations of the prostate pass on to a chronic condition.

To divide chronic prostatitis, of which the chief ætiologic factor is the gonococcus, into pathological and clinical varieties is of little moment. Clinically, the disease gives little evidence that can be put down as surely characteristic of one or another variety, and pathologically we usually find, in the same prostate, changes belonging to various forms of inflammation. At the same time the fact is not to be overlooked that chronic gonorrhœal prostatitis varies much in degree and in resistance to treatment.

*Symptoms.*—The majority of cases of chronic prostatitis run a mild course without subjective symptoms, the patients voiding perfectly clear urine. In others the symptoms are so well masked by the persistence of a urethritis that a precise diagnosis is difficult. In the remaining class, however, some of the characteristic symp-

toms appear: Disturbance of urination, the changes in the sexual function, abnormal sensations, referred pains, neurasthenia, suffering from pains across the back, down the thighs or in the testicles, constipation, pain before and after defecation, headache, and mental depression. With some patients frequency of micturition, which may be attended with pain, is the most prominent symptom and to this may be added the sense of not having completely emptied the bladder. With other patients the disturbances of the sexual function seems to stand out as the chief difficulty, such as absence of normal sensation at the moment of ejaculation, pain with the seminal discharge, distressing and persistent erections at night, premature ejaculations and decreasing sexual ability. It is in these individuals that we most frequently see the best marked types of sexual neurasthenia.

Some authors hold that prostatorrhœa is one of the chief symptoms of chronic prostatitis. The writer's experience coincides with those who consider prostatorrhœa as an unusual occurrence in this condition. The combination of chronic prostatitis and cystitis is by no means uncommon. In these cases the treatment of cystitis without recognition of the prostatitis, and attention to it, proves very disappointing.

All cases of persistent urethral discharge or a persistent morning drop or those cases with a chronic and constantly recurring discharge, should be suspected and examined for prostatitis.

*Diagnosis.*—Although the subjective symptoms give a valuable clue to the condition, an exact diagnosis cannot be made without digital exploration of the prostate by the rectum and, what is more important, microscopic examination of the expressed prostatic secretion.

A knowledge of how the normal gland should feel in the different periods of life is essential to the appreciation of size, configuration, consistence, and sensitiveness of the diseased organ. The changes in prostatitis noted by palpation are many. The gland is usually larger than normal, although this is by no means always the case, for in some instances it is found markedly atrophic. Frequently one lateral lobe only is affected, or the organ may be very irregular in outline and feel as though it were made up of many lobes. Nodulation may be abundant or there may be but one or

two nodes and these may vary in size, consistence, and location, but they are usually about the size of a pea, hard, and situated nearer the upper part of the gland. The general enlargement of the prostate which results from a parenchymatous prostatitis usually gives an edematous feel to the organ; having lost its normal firm and elastic consistence, it becomes, as some authors put it, flabby, this varying much in degree.

The condition following the follicular form is varied. The gland, as a rule, is not so large as in the postparenchymatous condition, but is usually harder, while here and there distinctly soft spots may be felt and the nodules are few or many, localized or scattered, as the case may be. Where there has been suppuration with escape of the pus, involving the whole gland, or one lateral lobe, or as in the follicular variety, small areas, the characteristic changes of contraction and firm cicatrices result and give that sense to the examining finger. In other cases there is no change in the prostate that can be appreciated by digital exploration, and no degree of sensitiveness; in these cases the diagnosis depends alone on the study of the prostatic fluid. Pain on palpation of the prostate is generally a sign of disease, but by no means always, and painful areas are not infrequently found in prostates otherwise negative to the digital touch.

The secretion which is collected at the external urinary meatus upon digital compression of the prostate, after the urethra has been cleansed by urination or irrigation, consists normally of a thin, milky fluid, at times slightly viscid. Its specific gravity is but little higher than that of water, it is usually faintly alkaline to the litmus test, and consists microscopically of lecithin globules, varying in size and usually present in great numbers, and epithelia which are partly cuboidal and partly columnar. A few leucocytes are normally present and occasionally some red corpuscles. Hyaline bodies of considerable diameter and the so-called *corpora amylacea* are not infrequently seen.

The changes from normal which most commonly take place in the prostatic fluid are in consistence and color. It becomes thicker, often flaky and yellowish or greenish-yellow from the addition of pus. Under the microscope there are added to the field of lecithin bodies pus corpuscles in varying numbers, scattered or in clumps, depending on the extent or kind of inflammation. In like manner

epithelia from the ducts and alveoli are added, and these in different stages of degeneration. Fat globules may be seen free in the field or in the epithelia or pus cells.

The *corpora amylacea* seem to be much less frequently seen in gonorrhœal prostatitis. It is to be especially remembered that as long as the presence of pus cells can be demonstrated a pathologic condition exists. Gonococci may be found in the pus cells and the fact that we cannot find them is not proof of their complete disappearance.

*Prognosis.*—When is the danger of infecting others past? When is a chronic gonorrhœal prostatitis cured? To these questions no clean cut answer can be given.

When the urine contains no more shreds or other abnormal elements, and the prostatic fluid is free from pus cells, and repeated search for gonococci with the microscope and by culture test fails, certainly we have no grounds on which to maintain that the patient is still afflicted with an infectious disease. But on the other hand, we cannot positively say that such individuals have become noninfectious.

After a few months or a year we find, in a large number of the cases, the presence of gonococci impossible of proof. Unfortunately, the mixed infection, which almost always complicates these cases, renders the task of clearing the prostatic fluid of pus cells exceedingly difficult, if not impossible. Although it has been stated that so long as pus cells remain a pathologic condition exists, yet experience has taught that these cases are by no means always infectious.

From the observation of 120 cases, von Notthaft has come to the following conclusions:

1. In the second half year after the infection there was 73% of the cases in which the gonococci could be proved to be present in the prostatic secretion. In the third half year this percentage fell to 50, in the fourth half year to 18, in the third year to 6. From the end of the third year no gonococci could be found in the prostatic secretion.

2. In the second half year there were other bacteria besides gonococci found in the prostatic secretion. In the fourth half year there were no cases in which a pure gonococcic infection could be demonstrated.

In a few patients from whom the writer made cultures the results were in accord with Notthaft's series so far as mixed infection was concerned, but in none of the writer's cases were gonococci found by either the microscope or culture, yet in 5 cases out of the 8, considerably over 50%, the infection was less than 18 months old. In 7 out of the 8 cases there was a growth of *Staphylococcus albus*, and in two of these there was added a growth of *Bacillus xerosis*. In one case there was no growth.

The conclusions to be drawn are that there is difficulty in proving the presence of gonococci in these older cases of chronic gonorrhœal prostatitis, and that other organisms play an active part in the bacteriology of this affection.

*Treatment.*—Where a urethritis exists, either anterior or posterior, therapeutic measures designed for the cure of this condition must be instituted. For the treatment of the chronically diseased prostate, massage of that organ by the rectum, constitutes the most important element of the treatment. The bladder should be filled with some such mildly astringent antiseptic as protargol, ½ of 1% solution. In very many cases dilatation of the prostatic urethra, either by sound or dilator, is helpful in the treatment by virtue of the internal massage and stretching it exerts, especially on the mouths of the prostatic ducts.

Digital massage, to be useful, must be done in a systematic and purposeful manner. Starting at the external upper part of the lateral lobe, the massaging finger-tip works its way toward the median line of the gland, again it is carried to the external border, immediately below the previous path of massage, and again worked toward the center. This is continued until each lateral lobe has been thoroughly gone over. Then the finger is swept over the lateral lobes downward and toward the center, emphasizing the pressure brought to bear on the median line, that the secretion may thus better be expressed into the urethra. The patient then voids the solution which has been left in the bladder, which thus washes out the urethra and comes in contact with the recently emptied prostatic ducts, which as some think, may take up some of the solution on the principle of a sponge which has been compressed and is allowed to expand while in contact with a fluid. This massage has two distinctly beneficial elements. It empties the alveoli and their ducts of the perverted

secretions which have accumulated, and it stimulates a more active circulation throughout the entire gland.

Again a warning against the danger of extending the process in massaging a prostate in which there still exists any active inflammation.

The massage which is done very gently at first, should be repeated once, twice, or sometimes three times a week, depending on the necessity of the case. A few weeks' period of treatment for the milder cases up to many months of treatment for the severer cases, is required. Besides massage, such measures as electricity or heat and cold applied to the prostate may in certain instances be helpful. Medicinal suppositories, as ichthyol, have a useful place in the treatment of prostatitis.

The advancement of the patients' general condition cannot be neglected and freedom from worry or other untoward influences must be secured. Favorable progress of the prostatitis is appreciated partly by the changes in the gland felt by the rectum, but more especially by the study of the prostatic elements microscopically. Improvement in subjective symptoms is unreliable.

Although the treatment is usually long and trying, taxing the patience of the physician and his patient, yet with well directed and conscientious care on the part of the physician and earnest co-operation on the part of the patient, the latter will be freed, in the greater majority of cases, from the danger of infectiousness and other consequences of chronic gonorrhœal prostatitis.

# FILARIASIS

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FILARIASIS is an epidemic parasitic disease which is of interest to genito-urinary surgeons because of the frequency of its manifestations in the generative and urinary systems.

Manson, whose work upon this subject has extended over a period of twenty years, states that there are four well-known nematodes which inhabit the circulation, and that there are probably other species. He gives the following nomenclature: The original filarial embryos, described by Lewis, are the ones which concern us here, and have been given the name *Filaria nocturna*. The other filariæ he has termed *Filaria diurna*, *Filaria perstans*, and *Filaria Demarquaii*. Two doubtful species he gives the names of *Filaria Ozzardi* and *Filaria Magallhæsi*. Prout has recently described another blood-worm under the name of *Filaria gigas*.

No pathological importance is attributed to any of these parasites except to the *Filaria nocturna*, which is the embryonic form of the adult worm *Filaria Bancrofti*, whose natural habitat is the lymphatic system of man.

Filarial disease occurs endemically in tropical and subtropical countries, and is prone to exist along the seacoast and large rivers. The origin of the sporadic cases, occasionally encountered in the colder climates, can usually be traced to one of the following geographical regions: India, Ceylon, China, the Malay Archipelago, Japan (particularly the most southerly islands), Egpyt, East Africa (especially along the coast of Zanzibar), Mombasa and Tanga, the West Coast of Africa, Senegambia, Madagascar, and Orange River Colony (Bloemfontein), Reunion, Mauritius, Australia (Queensland), New Caledonia, the South Sea Islands, Guiana, Brazil, United States of Colombia, West Indies, and Spain.

In the filarial districts a large proportion of the population is affected by the disease. In Amoy (China) Manson found one-eighth of the population affected. Thorpe found 25% of the natives of the Fiji Islands affected, and 32% of the Friendly Islands. In southern India, in the districts of Travancore and Cochin, Underwood reports one-tenth of the whole population as afflicted. Koniger states that 50% of the male population of Samoa have filariasis. According to Saville seven-tenths of the adult males of the island of Huahine, one of the Friendly group, suffer from the disease.

Vincent tabulates 500 cases taken indiscriminately from among patients at the Colonial Hospital, Port of Spain, and St. Anne's Lunatic Asylum, and from private sources. The percentage of blacks with filariasis was 4.9, of whites 10.9, and of East Indians 2.4. The percentage of infection in the case of the whites is strikingly high. The white population of Barbadoes and Demarara show a high percentage of infection, and in Trinidad, 14.5% of the white population are infected with this disease.

Indigenous cases in the southern part of the United States are on record. De Saussure, in 1890, reported 22 cases that he had observed in Charleston, S. C. Slaughter, in 1891, reported two indigenous cases in the northern part of Virginia. Mastin, in 1888, found such a case in Mobile, Ala., and Dunn has demonstrated filaria embryos in a woman who has always lived in Pennsylvania. Guiteras, in 1886, called attention to the presence of the disease in the southern states, four in Key West and one in Charleston, S. C. Cases occurring in the seaport towns can be explained by the constant communication with the filarial districts, but the origin of the indigenous cases is more difficult to understand.

The following case, a native of the United States of Colombia, was referred to me by Dr. C. H. Le Franc, of Cartegena, in May, 1904:

D. M., 35, M. Merchant; Spaniard; South American born.

*Family History.*—Excellent.

*Past History.*—No severe illnesses. Gonorrhœa three times, last attack twelve years ago. No complications or sequelæ.

*Present Illness.*—In 1885 the patient had a severe attack

of "chills and fever" which confined him in bed for two days. Associated with the fever there was moderate swelling of the scrotum and severe pain in the lumbar region. Nothing abnormal regarding the urine was noted. The "chills and fever" ceased in a few days, but the swelling of the scrotum persisted in slight degree. There was a similar attack once every year until 1892, when the pain in the back was much more severe and the urine became bloody. The scrotum at this time was the size of a cocoanut, and bunches, the size of the fist, appeared in each inguinal region. The "chills and fever" continued about four weeks, during which time the patient was confined to bed. As the "chills and fever" subsided, the swelling in the scrotum disappeared, and those in the groin diminished in great part. Diarrhœa was profuse at this time. The hæmaturia continued for three months. During this attack of hæmaturia he came to Boston and saw Dr. Arthur Cabot, who found filarial embryos in his blood.

The attack the following year, 1893, was less severe and he had no associated hæmaturia or diarrhœa, although the scrotum was abnormally large and the tumors in the inguinal region became enormously swollen. In 1894 there was again hæmaturia lasting one month. The pain in the back was severe at this time.

These attacks of chills and fever and swelling of the scrotum without further hæmaturia occurred once yearly until 1902, during which year he had three attacks of the same character already noted, associated with severe diarrhœa. At no time did the patient pass chylous urine. There was no frequency of urination, or difficulty or pain in performing the act except during the attacks of hæmaturia, at which time the passage of small bloodclots caused considerable pain.

The scrotum has remained swollen between the attacks, and there has been considerable pain in the region. There has also been constant dull lumbar pain. The scrotal pain was constant, of a dull, heavy dragging character, and was aggravated by walking or riding, and for which he has worn a supporter since 1892. It has been necessary for him to give up horseback riding for the last few years, on account of pain of a severe, sickening character radiating from the perineum into the epigastrium, causing him to become nauseated.

The patient states that he has suffered from melancholia for the past seven years, but there is no definite history pointing to this mental disturbance.

Dr. Le Franc states that when the scrotum and inguinal regions were acutely enlarged he believed there was fluid in the tunica vaginalis. The swellings subsided with the application of hot fomentations.

*Physical Examination.*—Well developed and nourished. Dark complexioned. Heart and lungs normal. Abdomen full, lax, tympanitic, not tender. Liver area normal, not felt. Spleen not felt; area not increased. Neither kidney palpable. Fullness throughout the course of both inguinal canals, producing an elongated swelling slightly more on the right than left, about one inch high and two inches wide, extending from the scrotum to the internal abdominal ring. These swellings are firm, but not hard, tender, or movable. They are deeply situated and continue into the scrotum along the spermatic cord. The scrotum is enlarged downward and laterally and appears distended by masses within. It is slightly fuller on the right than on the left side. Palpation shows a mass somewhat larger than the fist in the right upper quadrant; it is continuous with the mass in the right inguinal region and resembles a variocele to the touch. This is continued downward along the course of the spermatic cord. The vas deferens is clearly defined posteriorly. The right testicle is displaced into the perineum about one inch below the scrotum, and perineal junction. It is easily replaced into the scrotum, but drops back immediately when not held.

A similar but smaller mass is present in the left upper quadrant of the scrotum, which also continues downward along the spermatic cord, from which it is easily differentiated posteriorly. The cord on this side is slightly lengthened and presents the same character as that on the other side, and the testicle, which like its mate is normal in size and shape, is situated a little lower than normally.

The external inguinal ring on both sides, although only admitting the tip of the index-finger, because of continuation of the masses already noted into the inguinal canals, are considerably enlarged. There is no impulse or expansion of the masses on cough.

The skin of the scrotum is not thickened nor otherwise abnormal in character. No fluid is demonstrable in the tunica vaginalis, either by palpation or by the hydroscope. The cremasteric reflexes are equal and lively. The scrotum is diminished about one-third in size when the patient is lying flat. It is also diminished by the application of cold. The urethra admits a 27 *bougie à boule* to the triangular ligament and no obstruction is met in withdrawing it. The sound, 27 F., is passed into the bladder without meeting obstruction or deviating from a median line.

The *rectal examination* shows the prostate to be normal in size, shape, and contour, with a distinct median raphe. Both seminal vesicles are normal by palpation.

Extremities normal. Reflexes equal and lively. No general or local glandular enlargement.

*Urine Examination.*—Color normal; sp. gr. 1014; acid; no albumin, bile, or sugar; urea 2.8; cryoscopic freezing point 2.1; no apparent sediment. Centrifugalized urine shows no cells or casts. Occasional normal blood-corpuscles. A few sodium urate crystals. No embryo filaria found in many examinations at different times of day and night.

*Blood Examination.*—The blood examinations at different times are as follows:

May 12, 1904 (3 P. M.).—White cells, 5,200. Red cells, 5,640,000. Hgb., 90 %. No filariæ.

| Differential count of 100 cells: | Percentage |
|---|---|
| Lymphocytes | 38. |
| Mononuclear leucocytes | 4. |
| Polynuclear leucocytes | 51.5 |
| Eosinophiles | 6.5 |

May 14, 1904 (4. P. M.).—White cells, 5,600. Red cells, 5,600,000. Hbg., 90 %. No filariæ.

| Differential count of 100 cells: | Percentage |
|---|---|
| Lymphocytes | 36. |
| Mononuclear leucocytes | 6. |
| Polynuclear leucocytes | 50.5 |
| Eosinophiles | 7.5 |

(12 Midnight).—White cells, 11,5000. Red cells, 5,102,000. Hgb., 90 %. Many filariæ.

| Differential count of 100 cells: | Percentage |
|---|---|
| Lymphocytes | 40. |
| Mononuclear leucocytes | 6. |
| Polynuclear leucocytes | 35.5 |
| Eosinophiles | 18.5 |

May 16, 1904 (3 P. M.).—White cells, 54,000. Red cells, 5,120,000. Hgb., 95 %. No filariæ.

| Differential count of 100 cells: | Percentage |
|---|---|
| Lymphocytes | 30. |
| Mononuclear leucocytes | 45. |
| Polynuclear leucocytes | 60. |
| Eosinophiles | 5.5 |

(11 P. M.).—Many filariæ.

| Differential count of 100 cells: | |
|---|---|
| Lymphocytes | 45. |
| Mononuclear leucocytes | 4.5 |
| Polynuclear leucocytes | 31.5 |
| Eosinophiles | 19. |

May 18, 1904 (3 P. M.).—Examination by Dr. Pratt:

| | |
|---|---|
| Erythrocytes | 5,504,000 |
| Hæmaglobin | 100 %. (Sahli). |

No leucocytosis.

| Differential count of Leucocytes: | Percentage |
|---|---|
| Eosinophiles | 7.1 |
| Polynuclear leucocytes | 52.2 |
| Lymphocytes | 37. |
| Large mononuclear leucocytes | 3.3 |
| Mast cells | .4 |
| | 100.0 |

292 leucocytes counted.

(12 Midnight.).—White cells, 12,600. Many filariæ.

| Differential count: | Percentage |
|---|---|
| Lymphocytes | 36. |
| Mononuclear leucocytes | 6. |
| Polynuclear leucocytes | 37.5 |
| Eosinophiles | 20.5 |

June 7, 1904 (11 P. M., 18 days after operation).—White cells, 5,000. Red cells, 5,280.000. Hgb., 100 %. No filariæ found.

| Differential count: | Percentage |
|---|---|
| Lymphocytes | 28. |
| Mononuclear leucocytes | 4.5 |
| Polynuclear leucocytes | 62.5 |
| Eosinophiles | 5. |

Patient was seen in consultation by Dr. Abner Post and Dr. Joseph H. Pratt.

*Operation.*—May 20, 1904. Ether. Incisions about eight inches long, extending from the internal abdominal ring downward over the anterior surface of the scrotum along the course of the spermatic cord. The masses previously noted were found to be enormously enlarged lymphatics, and to a less extent dilated veins of the spermatic cord. As these continued into the inguinal canal, the fascia of the external oblique muscle was incised up to the internal abdominal rings. The vas deferens on both sides were dissected from the enormously dilated lymphatics, leaving a small amount of adjacent tissue for blood supply. The testicles, normal in every respect, were left attached to the vas of their respective sides. The cords, however, were ligated at a point about three-quarters of an inch above the epididymis. A clamp was applied about 1 cm. above the tie and the cord cut between, with a small escape of chylous fluid, which was caught on swabs for examination. The masses were somewhat diminished in size as they disappeared into the abdomen through the internal abdominal rings. These were transfixed at this point and tied. The mass was clamped just below the tie and cut between, with an escape of chylous fluid as before.

The testicles were then attached, by a mattress suture passed through the cut end of the cord, to a septum of the scrotum on either side, so that they assumed a normal position.

The vas deferens on each side was placed in its normal position in the inguinal canal and the fascia of the external oblique muscle was sutured by continuous chromic gut sutures. The superficial fascia was sewn in a like manner, and the external wound brought together by silkworm-gut sutures, while the scrotum wound was sewn by continuous chromic gut. A dry sterile dressing and a T-bandage were applied, with the scrotum elevated. Duration of operation one and one-half hours.

The patient took ether badly throughout the operation, frequently hiccoughing. About fifteen minutes after being removed from the table the patient, although having had a pulse of about 110 throughout the operation, was found to be pulseless. Strychnia, one-thirtieth of a grain, was given subcutaneously. Heaters, blankets, and elevation of the foot of the bed failed to produce a pulse of such a character that it could be counted. The patient was given three shock enemas consisting of coffee, brandy, and salt solution, at intervals of one-half hour. These did not materially improve his condition.

His skin and mucous membrane were blanched, and as he came out of the ether he was very restless, desired to be fanned, was very thirsty and complained of a sense of oppression. This, together with a barely perceptible pulse, pointed strongly toward hemorrhage. Examination of the wound two hours after operation failed to reveal anything other than a slight ooze. Percussion of the abdomen gave no signs of internal hemorrhage except for dullness in the left flank, which did not move with change of position, and which might well have been the retained shock enemas.

The patient was given fifteen minims of tincture digitalis intra-muscularly every three hours, and received one liter of normal saline solution under the breast, about two and one-half hours following operation. The condition certainly suggested internal hemorrhage, and, although special care was taken in tying off the spermatic cord, it was feared that bleeding was taking place from one of these stumps. However, operative interference was absolutely contraindicated on account of the patient's low condition. At the end of eight hours his condition remained practically the same, which fact, together with the knowledge of his condition immediately following operation,

pointed less strongly toward hemorrhage, the classical and technical signs of which still remained.

He was blanched and restless. Respiration 60 a minute. Temperature, 94°. Semi-conscious, feebly requesting water and air. Ten hours following operation the pulse became of slightly better quality, although it was still too rapid to be counted. From this time on his pulse gradually improved in quality, and the following day ranged between 150 and 160, but was decidedly thready in character. Forty-eight hours following operation the pulse had reached 120 and was of better quality; the temperature had jumped to 100.5°, and his general condition was fair, although he still remained blanched.

The patient improved slowly from this time, and one week following the operation the pulse was 80, of good volume and tension, and the respirations and temperature were normal.

The wounds healed by first intention and the stitches were all removed on the tenth day. The patient was up on the twentieth day following operation, and was discharged from the hospital June 9, 1904.

The blood was examined several times for filariæ, beginning twelve days after operation, but none were found.

The day following discharge from the hospital the patient noticed a small swelling in the upper part of the left wound. It was not tender and presented none of the signs of inflammation except a slight sense of fluctuation. A small incision was made into the mass, and about a half dram of a grayish gelatinous substance was obtained. Under the microscope this substance was found to be necrotic tissue. No evidence of a suture could be found, and nothing resembling any part of an adult filaria was seen. The wound was dressed twice daily for six days, at the end of which time only a slight granulating area remained, and the patient returned to South America.

Word occasionally received from Dr. Le Franc informs me that the patient has had no return of his symptoms, and that the embryos remain absent from the blood. On September 27, 1905, Dr. Le Franc stated that the patient had become the father of a child and that he had expressed himself as being much improved sexually since the operation.

In a letter received from the patient himself in January,

1906, twenty months after operation, he states that he considers himself entirely cured of his trouble.

I saw the patient two years after operation. He stated that he was in perfect health, that his sexual powers were greatly benefited by the operation, and that he had since become the father of two children. An examination showed no œdema of the scrotum nor lymph nodes in the groins. The testicles were in a normal position, not atrophied, and the cords were about normal in size. There are two points of special interest in this examination. One is that although the spermatic cord was entirely removed, except the vas deferens, there was no atrophy of the testicle. The testicle was attached to the scrotal septum, from which it probably obtained its nutrition. The second point of interest is that the size of the spermatic cord is now about normal. When it is realized that the cord was removed and the vas deferens alone left, it is of speculative interest to know what these structures are which surround the vas and resemble so closely the normal spermatic cord. Several blood examinations failed to reveal any filarial embryos and it seems fair to presume that this patient is cured of his disease.

*The Specimen.*—The mass of tissue removed from the *right side* is 24 cm. long. The lower end shows several small vessels cut across. The diameter at this point is 2 cm. The upper end, similar in structure, measures 2 cm. in diameter. From both ends the mass increases in size and the central point is ovoid in shape. This enlarged area measures 12 cm.x 6 cm.x 3 cm., and is made up of tortuous vessels from 1 to 5 mm. in diameter, resembling a varicocele. These vessels are surrounded by loose areolar tissue. The contents of these vessels is chylous.

The specimen from the *left side* is 21 cm. long and 4 cm. at its greatest width. Like the specimen of the right side, it consists of tortuous lymphatic vessels and areolar tissue, and two of the vessels can be traced the entire length of the mass. They measure 7 mm. in diameter, and the walls are 1 mm. in thickness.

The tissue was placed in normal salt solution and kept in a thermostat for several hours, but the worms did not appear.

The two masses of tissue were examined microscopically by Dr. S. B. Wolbach, of the Harvard Medical School. The

tissue was divided into slices, about 1 cm. thick. Every other slice was embedded in celloidin, and stained with hæmatoxylin and eosin. Twenty-eight blocks in all were examined.

The microscopic sections consisted of loose connective and fat tissue, with many thick-walled arteries and veins, some of which are obliterated by connective tissue. There is a marked lymphoid and plasma-cell infiltration in the connective tissue surrounding the capillaries and veins. There are numerous dilated lymphatics in the fat and perivascular tissue. There is a slight general infiltration of the connective tissue with lymphoid and plasma cells. No filariæ were found in the tissue examined.

It has been suggested by Dr. Wolbach that the worms may have escaped with the chyle which was emptied from the lymphatic directly after the operation.

*History.*—Certain manifestations due to the filaria sanguinis hominis received the attention of Arabian medical men as far back as the ninth and tenth centuries. The chief manifestation of which we have record was elephantiasis, which is the Greek translation of the words Da-al fil, meaning elephantine disease.

Chapotin, in 1812, had recognized endemic hæmatochyluria and communicated his knowledge in writing to Mauritius.

Nothing was known of the ætiological factor producing these various manifestations until 1863, when Demarquay, in Paris, first discovered the filaria nocturna in a chylous fluid obtained by tapping a hydrocele in a young man, a native of Havana.

In 1868, Wucherer, in Bahia, Brazil, found filarial embryos in chylous urine.

In 1868, Lewis, in Calcutta, also observed filarial embryos in chylous urine, and demonstrated them in the blood of a patient with chronic diarrhœa. He subsequently found the parasites in the blood and lymphatic secretions of individuals with elephantiasis of the legs and scrotum, and in the blood of persons presenting the symptoms hæmaturia, and considered the parasite to be the cause of these various manifestations. Lewis demonstrated the filaria without any knowledge of the previous discoveries, and gave the hæmatozoon the name of *filaria sanguinis hominis.*

It had been observed that the filaria did not grow to the adult worm in the human body. In 1878 Mason discovered that the mosquito was the intermediate host in which the embryo matured to the adult worm and then invaded man anew. He found that the filaria embryos were ingested with the blood by the female mosquito (the male having no sting), and were developed in the stomach. Some of the embryos were digested, others slipped from their sheaths and bored through the walls of the stomach, invading the muscles of the thorax, undergoing a metamorphosis, requiring two or three weeks until they were transformed into an actively mobile worm. He believed that matured eggs were deposited in stagnant water and that the filaria entered the human body in drinking water.

Bancroft found that the larvæ could not live in water, dying in from three to four days. His idea was that infection occurred by swallowing mosquitoes containing larvæ while asleep, with food, or the mosquito being killed, the filaria was transferred to the mouth by means of the fingers. He also believed in the transmission of the disease through the sting of mosquitoes.

Myers, to determine the truth of Manson's idea, fed monkeys with water in which mosquitoes fed upon the blood of filarial patients had laid their eggs. The results were negative.

Vincent, in 1895, proved by careful experiments that when the mosquito falls into the water, the filariæ, if unable to escape, die in twenty-four hours by imbibition, and in another series proves that the filaria does not pass from the living mosquito in the act of suction of water.

Lewis confirmed Manson's observations that the filaria larvæ pierced the walls of the mosquito's stomach and experienced developmental changes in the abdominal and thoracic tissue. Low demonstrated that the filariæ migrated to the head and proboscis of the mosquito and inferred that the parasite enters human tissue when the insect stings an individual.

Manson deserves the credit for our knowledge of the *life history and periodicity* of the parasite. He demonstrated that the embryos were present in the peripheral circulation during the night, and considered this periodicity to be an adaptation to the habits of the mosquito.

Mackenzie pointed out that if the patient slept by day and worked by night the habit of the filariæ reversed and they were present in the peripheral circulation during the day and not during the night. His observations were made by examining the blood every three hours during the day and night for a period of ten weeks.

The periodicity cannot depend entirely upon the sleeping state, as the embryos can be demonstrated between five and six o'clock or several hours before the patient retires. The number in the peripheral circulation increases, reaching a maximum about midnight, when from 300 to 600 are found in every drop of blood, which, assuming that the parasites are evenly distributed throughout the circulation, shows that there are from forty to fifty millions in the circulation at that time. The number gradually decreases from midnight, and they usually disappear entirely by eight or nine o'clock in the morning.

It is evident, therefore, that the sleeping state is not the cause *per se* of the increase in the number of parasites in circulation. The ingress begins several hours before the usual time for sleep and the egress is not complete until several hours after the usual time for waking. Further study may reveal a reasonable explanation for filarial periodicity.

In 1899 Manson demonstrated that when the filariæ are absent from the peripheral circulation they may be found in the larger blood vessels of the lungs, and less frequently elsewhere. His observation was made upon a patient suffering from lymphscrotum and varicose inguinal nodes. This patient committed suicide in the morning by swallowing hydrocyanic acid, death occurring almost instantly. A post-mortem examination six hours later revealed a large lymphatic varix occupying the pelvis and the back part of the abdominal cavity. In this varix, adult Filariæ Bancrofti were found. The embryos were noted to be most numerous in the large blood vessels and in the lungs. They were also found in the liver, spleen, and heart muscles.

*The Adult Filariæ Bancrofti.*—The adult Filaria Bancrofti belongs to the nematodes, and was first discovered by Bancroft, of Brisbane, Australia, in 1876, in a lymphatic abscess on a patient's arm. In 1877 Cobbold published the fact and named the nematode the Filaria Bancrofti.

The adult filaria, first found by Bancroft in 1878, has since been found by various observers. The adult filaria, however, has been found only in a very small percentage of the cases suffering from filariasis. In 1877 Lewis found a portion of a male and female worm in a blood clot from a lymphscrotum, after searching eight hours. In 1877 Des Santos, in Brazil, found five adult females in a lymphatic abscess of the arm. In 1881 Manson found a few fragments of a female worm in an abscess of the thigh, and in the same year demonstrated a female filaria in the dilated lymphatic in a case of lymphscrotum. In 1888 Sibthorpe, of Madras, India, found two worms, a male and a female, on the cut surface of a lymphscrotum. In 1894 Maitland, of Madras, India, obtained eight adult worms in lymphatic tissue removed from the inner surface of the upper arm in two operations; three were males and five females. Huber states that Czerny found a living female filaria in the ovary of a woman from Rio Janeiro. In 1897 Young, in London, removed a hard, nodular mass from a sailor, a native of Jamaica, who suffered from lymphscrotum, and varicose groin glands. This man committed suicide, and at autopsy the right varicose groin glands were found to contain three female filaria Bancrofti. In the lymphatics of the right spermatic cord six more adult female worms were found. In the left spermatic cord seven worms were found, one being a male. In 1890 Lothrop and Pratt found nine worms, two males and seven females, in the lymphatics of the epididymis, following castration for filariasis. In 1903 Opie found an adult worm in the right epididymis, at autopsy. Primrose, in 1903, obtained an adult filaria and several fragments in an operation for lymphscrotum.

Taniguchi records 4 cases in which the adult worms were found. One case was a male suffering from inguinal lymphvarices. Two adult worms were recovered at operation. His other case was a woman who had several small nodes in the breast. At operation several adult filariæ Bancrofti were found. The remaining 2 cases recorded by Taniguchi belonged, one to Ikeda, and the other to Kumono. Both these cases were operated upon for inguinal lymphvarices and lymphscrotum and the worms were found in each instance. The number and sexes are not recorded.

It is seen, from the above, that the female is much more commonly found than the male worm, and that the location in 15 out of the 19 cases was in relation to some part of the generative system: Lymphscrotum (Lewis, Manson, Bibthorpe, Primrose, Taniguchi, Ikeda, Kumono), chylocele fluid (Bancroft), epididymis (Lothrop and Pratt, Opie), ovary (Czerny), spermatic cord (Young), arm (Bancroft, Maitland, Young, and dos Santos), leg (Manson), breast (Taniguchi).

*The adult parental forms of the filaria Bancrofti* are long, hair-like, transparent nematodes, from three to four inches in length. The male and female are often found coiled about one another, within dilated lymphatics and the lymphatic glands themselves.

The female is considerably larger than the male, and measures from 8.5 to 9.5 cm. in length, and is the thickness of a human hair. Macroscopically the worm is a small, slender, delicate, whitish, hair-like body. Microscopically the head is rounded with an unprotected oral orifice. The tail, which is slightly tapering, has an abrupt end. The anal aperture is situated just in front of the termination of the tail, while the sexual openings are near the head. The digestive tract is a simple tube, and the remainder of the body is occupied by the sexual organs. Manson states that the worm is normally viviparous, but that the eggs are sometimes prematurely deposited so that it becomes oviparous.

The male worm is shorter and slenderer and has a marked disposition to curl. Daniels gives his length as 4.4 cm. Manson describes two slender unequal spicules originating at the cloaca.

*Embryos.*—The embryos are found in the peripheral circulation as delicate, translucent, smooth, almost cylindrical bodies. The head end is rounded and the caudal extremity is pointed. Scheube states the average length to be 0.216 mm. and the breadth 0.004 mm. The parasite is enveloped in a transparent sheath which is longer than the embryo, and which is sometimes seen trailing after the head or tail, or both. The embryo has been observed to move about within its sheath. When studied in freshly-drawn blood the movements are continuous, but not those of progression. The tail whips from side to side

actively amongst the blood corpuscles. It writhes and coils with much activity. The embryos remain alive for several days if the preparation is prevented from disintegration.

Under high magnification there is an irregular granular mass observed at the posterior part of the middle third of the parasite, and a very delicate transverse striation can be detected throughout the entire length of the embryo. By staining with a mild solution of hæmatoxylin Manson has demonstrated a V-shaped patch at a point of about one-fifth the entire length of the organism, backward from the head end, and a similar spot, though smaller, situated a short distance from the end of the tail. The former of these he terms the "V-spot" and the latter the "tail spot," and considers them to be connected with development, the anterior one being the future water vascular system, or generative organs, and the posterior one for the anus or cloaca. Manson has also found in filarial embryos whose movements have almost ceased that the head is constantly being uncovered from a very delicate prepuce, and can sometimes demonstrate that a short fang is shot out and retracted from the center of the head.

*The Life History of the Filaria Nocturna.*—The mosquito is the intermediate host, and man the definite host. Female mosquitoes of the genus *Culex* (*C. fatigans*), and, according to James, *Anopheles* (*A. niggorimus*), draw the filarial embryos from the infested individual. The parasites find their way to the stomach, where they escape from their sheaths, which they leave behind. They penetrate the stomach and enter the thoracic muscles of the insect, where they undergo a metamorphosis, which, according to Manson, requires from sixteen to twenty days to complete. The embryo is then transformed into a worm a sixteenth of an inch long, with the activity of the young parasite. A mouth and alimentary canal, and a trilobod tail, may be distinguished. Less often these larval forms may be demonstrated in the abdomen as well as in the thorax. When this metamorphosis has taken place the majority pass forward by the prothorax and neck of the mosquito, and, as Low has pointed out, enter the proboscis. This observation has also been confirmed by Manson, Annette, Dutton, and James. Manson states that in all the sections of this region which he has examined he has

found two worms together in each instance. The parasite remains in this position until the mosquito feeds upon some warm-blooded vertebrate, at which time the parasite enters the definitive host. Bancroft found that filarial infested mosquitoes, fed upon bananas or other vegetable substances, do not part with the filariæ situated in their probosces.

After entering the human body the filaria finds its way into the lymphatic system, where it remains and develops into the mature parent worm.

*Pathological Changes Produced by the Presence of the Filaria Nocturna.*—The presence of filaria in the human body does not always give rise to manifestations. In the majority of individuals afflicted, ill effects are produced by the obstruction of the lymphatics, and the greater proportion of such manifestations are associated with the generative and urinary systems; and furthermore, the parent worm is most often here located.

It is not known that the parent filaria lives elsewhere than in the lymphatic vessels in the human body, nor is there evidence that they migrate from one part of the body to another. It is not known how long the parent worms may remain alive, and persons living in filarial districts are probably infected many times.

No pathological changes are produced by the embryos, so far as is known. The parent worms, on the other hand, produce obstruction directly or indirectly in the lymphatic circulation. While it is rare that the worms produce occlusion of a lymph channel, their presence results in secondary changes, thickening the lymphatic walls and narrowing their lumina. Moreover, the location of the parent worm is not infrequently the seat of infection, producing abscess and lymphangitis, which further changes the structure of the lymphatic channels. Manson states that the ova are capable of obstructing the smaller lymphatics and statis may be thus produced.

By thrombosing lymphatic channels there is a rise of lymph pressure in the occluded vessels resulting in varicosities and lymphatic œdema. As an effect a compensatory circulation is established.

*Local Manifestations.*—Great variation of the disease filariasis is displayed, dependent upon an engorgement of the lymphatics distal to the point of occlusion.

Flynn records 50 cases of filariasis, the clinical evidence occurring as follows: *Chyluria*, 9, 8 being males (one showed a palpable varicose condition of the prostate); *elephantiasis*, 7, 6 being females; *lymphscrotum*, 5; *chylous hydrocele*, 12; *intermittent orchitis*, 4; *varicose groin glands*, 13, all bilateral, and all in males.

The following changes are well recognized occurring singly or existing together: (1) Dilated lymph vessels,—*lymphatic varix*, *lymphangiectasis;* (2) dilated lymph glands,—*varicose glands;* (3) cutaneous lymphatic obstruction occurring as œdema,—*lymphscrotum*, *lymphvulva*, and *elephantiasis Arabum;* (4) rupture of dilated varices, producing chyluria, chylous hydrocele, chylous ascites, or chylous diarrhœa, according to the organ into which the rupture takes place; (5) manifestations produced by secondary pyogenic infection,—lymphangitis, cellulitis, and abscess.

*Dilated Lymph Vessels. Lymphatic varix—lymphangiectasis.*—By occlusion of the lymphatic channels there is a rise of lymph pressure; the lymphatics distal to the obstruction become dilated, and a compensatory circulation is soon established, resulting in the formation of a lymphatic varix, varying in degree according to the amount of obstruction. The site of the obstruction, of course, varies the location of the varix. When the obstruction is in the thoracic duct, the chyle can only reach the circulation by a retrograde flow through the lymphatics of the groin, scrotum, pelvis, and abdomen. Dilation therefore takes place in all the lymphatic vessels below the point of obstruction in the thoracic duct. Manson depicts a case of Mackenzie's in which the abdominal and pelvic lymphatics formed a varix about a foot in diameter, concealing the kidneys, bladder, and spermatic cords.

Opie reports the autopsy upon a case of filaria sanguinis hominis in which a plexus of enormously dilated lymphatic vessels was situated in the abdomen and pelvis, in front of the vertebral column. The plexus was continued along the whole course of the thoracic duct. From the plexus lymph varices extended along both spermatic veins as far as the epididymis, and a similar mass of dilated lymphatics was continuous along the course of the femoral artery and vein, and formed a mass in the groin.

This mass was mistaken for a hernia at the patient's entrance to the Johns Hopkins Hospital, and was cut down upon, but not removed. The diagnosis of the true condition was not made until after death. Brodel's drawing of this case is the best illustration in literature.

*Dilated Lymph Glands* (*varicose glands*).—It is unusual to observe varicose glands elsewhere than in the groins and femoral regions. Dilated lymphatic vessels can usually be demonstrated running to and from the nodes. The increase in size of the nodes is slow and usually without symptoms and they often attain a considerable size before they attract the patient's attention.

Upon inspection they resemble herniæ and unless they have been the seat of inflammation the skin is freely movable, the mass is soft, doughy, not tender, with an ill-defined outline. They decrease in size while the patient is in a recumbent position, and slowly enlarge when he is erect. The absence of impulse upon cough, tympany on percussion, and the demonstration of a normal sized external ring, may be the only features distinguishing it from inguinal hernia; and when situated in the femoral region the diagnosis is less easy.

The adult worms may have their seat somewhere in the thoracic duct, and the varicosities may be but a part of lymph varices existing in the abdomen and pelvis, as in Opie's case. On the other hand, the parasites may be situated in the groin glands themselves. If a chylous fluid is obtained when the lymph glands are tapped, the obstruction is probably in the thoracic duct, but if the fluid is not milky, but clear, the parasite is probably contained within the mass.

*Cutaneous Lymphatic Obstruction Occurring as Œdema.*—*Lymphscrotum* results from obstruction in the lymphatics of the skin and is usually accompanied by dilated lymph glands. Small varices may appear on the scrotal integument. These sometimes rupture with the escape of lymph. Inflammation is prone to occur and ulcerations, cellulitis, or abscess formations may develop in the deeper layers of the skin, while eczema is often encountered upon the surface.

*Lymphvulva* does not differ in any way from lymphscrotum.

*Elephantiasis Arabum.*—There has been some dispute as

to whether this condition is a manifestation of filariasis. Manson, however, has recently presented evidence in support of this theory. This affection does not, however, concern us.

*Rupture of Dilated Varices*, producing *chyluria*, *chylous hydrocele*, *chylous ascites*, or *chylous diarrhœa*.—In the condition cited the parasites are probably located in the thoracic duct, or one of its affluents, or in the tissues about the abdominal aorta. Engorgement and a retrograde current in the dilated vessels results. The pressure within the vessels may be sufficient to cause them to burst. The viscus into which the rupture takes place becomes the site for the collection of the chylous fluid. If this occurs anywhere along the urinary tract a mixture of urine and chyle results. If the rupture takes place into the tunica vaginalis, it results in chylous hydrocele, or chylocele; the abdominal cavity, chylous ascites; and into the bowel, chylous diarrhœa.

*Chyluria*.—Although the presence of chylous urine comes on suddenly it is the commonest external manifestation of filariasis. The rupture of the dilated lymph-channel may take place anywhere along the urinary tract, most commonly in the bladder and kidney. The urine contains, besides its normal constituents, chyle and lymph. The color of the urine varies with the process of digestion. It is usually milk-white soon after digestion has commenced, on account of the excess of fats. Because of the presence of the lymphatic contents when the process of digestion is not active, the urine is turbid when voided, and soon separated into three or more distinct layers.

Hemorrhage may be associated with chyluria, when the condition is spoken of as *hæmatochyluria*. It is believed by some that the sanguinous character of the urine in *hæmatochyluria*, is due to the rupture of the blood vessels at a point near the place of rupture of the lymphatic vessels. Manson, however, attributes the presence of blood in the urine, in such cases, to the formation of blood corpuscles in the lymph contained within the varicose vessels.

The urine may suddenly become normal in color, probably from a closure of the fistula. There is a tendency for chyluria to recur, and Lancereaux records a case where it was persistent for fifty years.

Chyluria is found to occur after childbirth, or violent effort in those suffering from filariasis.

The site of the Filaria Bancrofti in this condition has never been absolutely demonstrated. Ponfick and Havellburg each record a post-mortem, and Mackenzie has had two cases which came to autopsy, and in no instance were the parent worms found. Pain in the back is usually present, from the greatly distended lymph-varix within the abdominal cavity.

Retention of urine sometimes results by chylous coagulation in the bladder and is not infrequently the first indication of trouble in the urinary system.

Flynn has demonstrated a positive Widal reaction in one case. The test has not been applied to any other cases, so far as I am aware.

*Chylous hydrocele* is the result of chyle being poured out in the tunica vaginalis. In the case reported by Lothrop and Pratt the dilated lymphatics of the spermatic cord were excised. This prevented the normal return of lymph from the testes and an accumulation of chylous fluid resulted in the tunica vaginalis.

A chylous hydrocele presents the ordinary physical signs of a serous hydrocele except that the translucency is diminished. The parent worms are usually situated in the region of the testicles.

Manson, recording 62 cases of filariasis, found 6 cases of chylous hydrocele. Flynn records 12 cases in a series of 50, and has demonstrated quantities of cholesterin crystals in the fluid drawn from the tunica vaginalis. Embryos have been demonstrated in chylocele fluid by many.

*Chylous ascites* is dependent upon the escape of chyle from the abdominal lymphatics into the peritoneal cavity.

*Chylous diarrhœa* is the result of the emptying of the dilated lymphatic vessel into the intestinal canal.

*Manifestations Produced by Secondary Pyogenic Infection. Abscess, lymphangitis,* and *cellulitis.*—Whether or not on account of injury to the lymphatics by a blow or otherwise, the parent filaria sometimes dies, and acts as an irritant, producing inflammation, often resulting in abscess, in the contents of which fragments of the dead filaria have been found.

If the inflammation is within the abdomen the general

abdominal symptoms dependent upon inflammation are evident.

*Lymphangitis* and *cellulitis* occur commonly in all forms of filarial disease, particularly in varicose glands, lymphscrotum, and elephantiasis. The lymphatic-trunks become cord-like, reddened, hot, and painful. The adjacent tissue and skin become inflamed and tense, and constitutional symptoms, ushered in by a prolonged rigor, with subsequent fever, continue for several days. Delirium and death may result. Usually, however, the attack is relieved by a discharge of lymph upon the surface of the skin, and a profuse general diaphoresis. This condition is spoken of as "elephantoid fever."

*The Blood.*—Filarial disease seems to exert little influence upon the red corpuscles or hæmoglobin. The white cells are, however, increased in number and there is a relatively high percentage of eosinophiles.

Gullard records a case in which the leucocytosis varied from 4,600 to 13,500, and the eosinophiles between 3 and 12%. In this case there was a constantly high proportion of lymphocytes, as well as eosinophiles, and the polynuclear forms never reached the normal minimum of 70%. The most interesting point about Gullard's case is that the percentage of eosinophiles rose from a normal figure in the morning, when no filarial embryos were present, to a high percentage just before midnight, when a large number of embryos were in circulation.

Calvert found a leucocytosis and eosinophilia in two Filipino prisoners. He showed also that the percentage of lymphocytes was fairly high, and believes that filariasis, like trichinosis and akylostomiasis, has a positive chemiotaxis for eosinophiles, and that whenever the parasite is in the body there is an eosinophilia.

In one of Calvert's cases the leucocytosis reached 26,666, and in the other 14,000. The eosinophilia in the first case varied from 8. to 22., and in the second from 3. to 20.5.

He found the leucocytosis and eosinophilia to be most marked during the daytime, that is, when the embryos were not in the peripheral circulation.

Wherry and McDill found an eosinophilia varying from 6.0 to 10.0 in the morning, and 12.0 at midnight. Unlike Cal-

vert's observations, they found the eosinophiles to be most numerous when the embryos occupied the peripheral circulation in the greatest numbers.

Wurtz and Clerc record an eosinophilia of 38.0, and in Lothrop's and Pratt's case the eosinophiles varied from 3.5 to 4.6.

Remlinger and Menchen Hodara-Bey record two cases of chyluria occurring in Egyptians. In these cases the eosinophilia was very high; in the first case 70.0, and in the second 75.0. They noted certain morphological changes in the eosinophiles. Each eosinophile presented very marked granulation in the protoplasm. Some leucocytes were observed, in which the granular material was outside of the cell, as though the cell-capsule had ruptured. They feel that the phagocytic property of the leucocytes is diminished by this granular invasion and disintegration of the cells; and on this account suppurative processes are so common in filarial patients.

In the writer's case the blood observations show an increased number of leucocytes during the time at which the filarial embryos are in the peripheral circulation, and also a relatively high number of eosinophiles at this time. These observations are in accord with those of Gullard and those of Wherry and McDill. The lymphocytes remained constantly high, and were increased with the eosinophiles. There was little change in the mononuclear leucocytes from normal, but the polynuclears were decreased at all times. The eosinophilia, although slightly increased during the day, rose to a maximum at the time when the embryos were most numerous, reaching 20.5.

Following operation the red cells and hæmoglobin remained unchanged. The white cells showed no increase. The differential count showed that the lymphocytes had dropped almost to normal; that the mononuclear cells were normal, and that the polynuclears had risen and the eosinophiles fallen almost to normal percentages.

*Prophylaxis.*—There seems to be no doubt that filariasis is transmitted through the mosquito; therefore, any prophylactic measures against infection must depend upon protection from mosquitoes.

By special conditions for breeding the *Anopheles* may be

annihilated from a locality. The *Culices* breed more readily, and select any collection of water for this purpose.

The protection of stored water from the insects and the frequent emptying of vessels containing water, so as not to allow sufficient time for larvæ to mature, and employing only that water which is freshly filtered, are the only means for the prevention of infection from this source. Mosquito-nets should be worn as a safeguard when in filarial districts. Individuals infected with filariæ are a constant source of danger to the community.

*Treatment.*—So far as is known, the embryos are not harmful, and the treatment is therefore directed toward killing or removing the parent worm.

*Medical Treatment.*—Numerous drugs have been employed in attempting to cure filarial disease. Flint recommends methylene blue, 0.12 every four hours, and believes that he cured a case of chyluria by this means. Zellweger claims to have produced good results in 5 cases of lymphscrotum and chyluria with this drug, while Henry found methylene blue absolutely inefficacious. Thymol, benzoic acid, benzoate of soda, and boric acid have also been supposed to have a beneficial effect. Scheube claims to have killed the parasite by administering picricnitrate of potash.

The most commonly employed drug is quinine, and although weak solutions will kill the embryo outside of the body, it seems to have no effect whatever upon them while in the circulation.

Recently Wherry and McDill exposed the back of a patient suffering with hæmatochyluria to the X-rays. After the exposure the embryos were found to be in no way affected.

In hæmatochyluria some relief of symptoms has been gained by bladder irrigation with mercurial chloride, 1–10,000, boric acid, and other solutions of mild antiseptics. When the bleeding is considerable adrenalin chloride has been injected into the bladder, and given by mouth, with good results.

Medical treatment must be considered to be of use only to palliate the symptoms arising as manifestations of the disease itself.

*Operative Treatment* to be anything more than symptomatic and palliative must be directed toward removing the parent worm. The thoracic duct, pelvic, and abdominal lymphatics are not

readily accessible, and when the parent filariæ are here situated the only form of treatment that can be employed is absolute rest, with the hips elevated to reduce the hydrostatic pressure, and a light diet with restricted fats. Diuretics and cathartics are of value in reducing the tension within the lymphatics.

However, even if the adult worms are so situated and the lymphstasis has produced dilated lymph glands, lymphscrotum, chylocele, or other external evidences of the disease which are annoying to the patient, operative treatment, as a palliative measure, has been followed by marked beneficial results. If, on the other hand, the local condition harbors the parent filaria, an operation removing the lymph vessels, and the adult filariæ Bancrofti, will be curative.

Three distinct objections have been put forth against operation for the removal of lymphatic varices, and lymph adenocles: First, that such operations are unscientific in principle, because only a portion of the varix is removed and the obstruction in the lymph circulation still remains. Second, that persistent lymphorrhagia and lymphatic fistulæ follow. Third, that such operations are liable to result in septic infection or erysipelas.

Operative experience has shown, however, that the varices are often local and can be entirely removed; that the patient may be cured of his symptoms even though the parent worms are not demonstrated in the excised mass; and that when the parent filariæ themselves are removed the patient is truly cured.

Maitland, who has had considerable operative experience with this disease, and who is familiar with the experiences of other surgeons in Madras and elsewhere, states that he has never known or heard of a lymphorrhagia or lymphatic fistula resulting from operation. Maitland states also that he has not seen or heard of a fatality by septic inflammation or erysipelas resulting from operation. He further states that a tight dressing placed over the wound causes the lymphatic channel to become sealed, and oozing does not take place in a greater degree than would from any operation wound.

Experience has proven that the suffering produced by the constantly recurring attacks of pain, erysipeloid inflammations and constitutional symptoms, has been relieved by removing varices which are accessible.

Following are brief outlines of the cases which have been operated upon:

PRIMROSE records a case of a man suffering from filariasis, upon whom he operated for lymphscrotum. In the excised tissue an adult filaria and several fragments were found. Twenty-four days after operation embryos were abundant in the blood; which showed that all the adult filariæ had not been removed. Forty-six days later the patient had an attack of lymphangitis in the neck. A circumscribed swelling developed, which was opened ten days later and sloughing tissue was removed. No adult worm was detected. Sixty-seven days after the second operation all embryos had disappeared from the blood.

MANSON expressed the opinion regarding this case that the first operation upon the lymphscrotum was not the one which cured the patient, but that the lymphangitis in the neck was probably the site of the remaining parent worm.

MR. H. J. STILES operated upon varicose groin glands in a case in which Gullard studied the blood. No mention, however, as to the final outcome was made.

BROWN operated upon a case in which there was a straw-colored fluid in the tunica vaginalis. The testicle and the lower third of the vas deferens were removed. A small nodule was found situated in the testicle just under the epididymis. It had a compact fibrous periphery, and in the center was a yellowish-white, semi-fluid material. Smears were stained for tubercle bacilli, but none were found; instead, however, larvæ of the filaria sanguinis hominis were discovered.

MAITLAND reports 3 cases upon which he has operated with good results. First, a case of lymph gland of the right groin. The entire mass was removed. The patient had remained well at a period four years after operation. Second, the case was of an individual with a large lymphatic varix in the right femoral region. The result nine years after operation was entirely satisfactory, and Maitland quotes portions of the patient's testimony, one sentence of which is as follows: "It is beyond description to write of the benefit of the operation." Nine years after the operation the patient was again attacked by the disease, the lymphatic obstruction being in the inter-abdominal vessels. The third case was one with a large lymphatic varix in the right groin,

and a smaller one in the left groin. The mass in the right groin was removed, and suppuration occurred in the wound. One month after operation no filariæ could be demonstrated in the blood. The year of this operation was 1894. Maitland's report was in 1902, and in that time, he stated, the patient had remained well, and the varices in the left groin had caused no trouble.

FLYNN removed a varicose tumor of the left spermatic cord, leaving the testicle and vas deferens. The parent worms were not found, but the embryos disappeared from the blood, and it is believed that they must have escaped detection in the mass. Flynn has done partial excisions of the tunica vaginalis in five patients, and, as he expresses it "each patient considers himself cured."

LOTHROP removed a varicose spermatic cord, together with the testicle and tunica vaginalis. Nine parent worms were found, and although filarial embryos were persistent in the blood the patient was relieved of his symptoms.

GODLEE, following the suggestion of Manson, cut down upon a lymph varix in the right groin, and anastomosed a dilated lymphatic vessel with a tributary of the internal saphenous vein. The result was that the lower part of the swelling disappeared. The upper part remained, however, and a month later he anastomosed one of the dilated lymphatic vessels of the cord with one of the spermatic veins. The swelling disappeared and has remained so. Manson and Godlee believe that the obstruction to the thoracic duct was opposite the lymphatics accompanying the spermatic vessels, and that although the obstruction still remains there is no regurgitation of chyle.

GODLEE operated upon another case with large swellings in both groins. The swelling in the right groin was exposed, and one of the lymphatics anastomosed with a vein. At a second operation the swelling in the left groin was exposed, partially removed, and a lymphatic was anastomosed with a tributary of the internal saphenous vein. A portion of the tumor in the right thigh was removed at the same time. There was considerable oozing of chyle and lymph subsequently, but the wound healed rapidly. The improvement was not so marked as in his previous case.

The cases of filariasis treated surgically are comparatively

few. The relatively large number treated medically, and the little benefit so obtained, leads one to hope that more cases may receive surgical treatment. Even though the parent worms are not found, as in the writer's case, they may be retained within the diseased mass and escape detection, the embryos disappearing from the blood, and the individual remaining free from his symptoms.

On the other hand, when the parent filariæ are known to be left alleviation of the symptoms has followed by overcoming the stasis and regurgitation of chyle.

It is not without interest to note that there are 5 cases which committed suicide while under observation, and that another attempted suicide, but failed.

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## THE OPERATIVE TREATMENT OF ACUTE GONORRHŒAL EPIDIDYMITIS

By FRANCIS R. HAGNER, M.D., of Washington, D. C.

WHEN the earlier cases, here reported, were operated upon, I knew that puncture of the epididymis and tunica albuginea had been practiced for the relief of pain in these conditions, but was unaware of the performance of any open operation for this complication of gonorrhœa. Upon investigating the literature of the subject, however, I found that incision of the tunica albuginea had been practiced some fifty years ago for orchitis. Mr. Smith [1] states that Pirogoff, in 1852, punctured the testicle for orchitis. (I may say here that most of the older writers seem to make no distinction between orchitis

and epididymitis.) Mons. Vidal de Cassis was the first to make an incision through the tunica albuginea and received the sanction of Mons. Ricord. In 1863 H. Smith reported, in the *Lancet*, that he had performed the operation, resorting to it because of an erroneous diagnosis of abscess of the testicle, the result being a discharge of blood and serum, but no pus, with complete relief of pain, which led him to practice it on the incredible number of 1,000 cases, reserving it only for the severer forms. This statement led to a ludicrous discussion between Mr. Smith and Mr. Holmes, the latter taking the position adverse to operating, all of which appears in the *Lancet* of 1864. Watson and John Hunter seem to have been the first to regard the swelling due to gonorrhœa as affecting both the testicle and the epididymis. And the former cited the anatomical analogy between the eye and the testicle as to its firm, fibrous, capsular covering. As iridectomy and puncture of the sclerotic coat was a well-recognized therapeutic measure, they concluded that puncture of the tunica albuginea was indicated. Macnamara [2 3] bears out Watson in this analogy by iting the great relief afforded glaucoma by puncture.

Puncture of the tunica vaginalis was recommended by Mr. Spencer Watson in 1867. In an experience of 20 cases, particularly when effusion was present, it seemed to give as much or more relief than puncture of the tunica albuginea. It is apparent after a careful examination of the literature, that it has been only in comparatively recent years that the involvement of the epididymis was recognized of more moment in gonorrhœal infection than the involvement of the testicle.

Dr. W. T. Belfield [4] published a very interesting article, under the title of *Pus Tubes in the Male and Their Treatment.* I will quote rather freely from his paper, as his experience and mine coincide very closely in a great many ways. He states that it is the general belief that pus rarely forms in gonorrhœal epididymitis, but it is his opinion, and one in which I fully concur, that in a considerable proportion of the cases, where the tunica vaginalis contains fluid, and an œdema of the skin appears, pus is present in the epididymis. In fact, in one of my cases, where there was no œdema of the skin and only a slight hydrocele, pus, in which were numerous gonococci, was found after puncture of the epididymis. He regards the condition as quite analogous to pyosal-

pinx and recommends a similar treatment—surgical in character—making a good free incision into the globus minor to permit of free evacuation of pus and to allow drainage.

Baerman,[5] in the pathological study of 28 cases, deduced some valuable conclusions, which are undoubtedly correct and which ought to throw much light on the future care of these cases. They are: (1) In a considerable proportion of cases of epididymis, abscesses are formed in the epididymis. (2) Suppuration is regularly followed by the appearance of hydrocele. (In my experience hydrocele has formed when no pus was demonstrable.) (3) Gonococci are found in foci in the epididymis years after the urethral infection occurred. (4) Early puncture is advised to save the canal from occlusion. (5) The hydrocele should be punctured to improve the circulation. (6) Incision and drainage of the infected epididymis should be more frequently practiced.

Since becoming interested in this work I have endeavored to secure a testicle in a state of acute gonorrhœal inflammation, but, to my great disappointment, have failed, and therefore I will have to rely on the excellent pathological reports of Monod and Terrillon in their book entitled *Traité des Maladies du Testicule et ses Annexes*. These observers have deduced the following facts by their exhaustive experiments and pathological studies: (1) "In gonorrhœal diseases of the testicle, the epididymis only is involved." From my limited experience this appears to be true, as there seemed to be no change in the testicle proper in any of my cases, and in one very severe case I punctured the tunica albuginea and observed an apparently healthy condition of the testicle.

(2) "There is a marked dilatation of all the tubes of the epididymis, which they believe to be due to the pressure caused by the infiltration of the inflammatory exudate into the connective tissue surrounding the tubules, resulting in more pressure at one point than another, and hence the obstruction produced causes a backing up of degenerated epithelial cells, pus, refractive granular material and spermatozoids." If Monod and Terrillon be correct in stating that the infiltration in the connective tissue of the epididymis causes the obstruction of the tubules in severe cases of epididymitis, then anything that will prevent or lessen this infiltrate is rational and justifiable. Even in the cases where pus is uot found, the infiltration is certainly relieved by the puncture.

(3) "Such obstructions have been known to lead to a most distressing complication, namely, degeneration of the seminiferous tubules with resulting atrophy of the testicle." Therefore any operation that will rapidly relieve the tension in the early stage is a most important step in the right direction.

Experiments made by Monod, Terrillon, and Kocher to produce artificially the macroscopical picture of gonorrhœal epididymitis, tend to show that the enlargement of the epididymis is due to the inflammatory exudate into the cellular tissue surrounding the tubules rather than to the changes which occur in the tubules themselves. After having dissected off the connective fibrous tunic from the cord and having made an opening at its upper and anterior border, they fixed a cannula into the cellular tissue. Through the cannula they injected a weak solution of gentian violet. When the fibrous tunic had been sufficiently filled they saw that the induration characteristic of this special form was reproduced, and resembled an increase in size of the epididymis.

I have recently duplicated this experiment, precisely as described above, and present herewith the results by means of two drawings made from photographs.

Figure 1 shows the testicle, before injection, with the tunica vaginalis dissected off. The second illustration shows the same testicle after injection with a solution of gentian violet, the needle having been inserted through the fibrous covering of the epididymis in the regions of the globus major and minor. The encroachment of the epididymis upon the testicle is shown, and the picture certainly resembles the condition seen in a mild case of epididymitis. Of course, in a true epididymitis the infiltration is much greater than can be produced artificially.

I realize thoroughly that in epididymitis most cases will recover with only medical treatment, but judging from my own cases, limited in number, I do not believe that the severe cases will recover as rapidly or with as little apparent anatomical disorganization, when medical treatment alone is employed. Feeling this to be true, I have operated on only the severe cases coming under my care. Although my confidence in the operation is great, I do not feel I have as yet had sufficient experience to recommend operation in every case, but I believe there will be an increasing proportion to be treated surgically in the future.

The analogy between the two affections and the good results secured by opening and irrigating gonorrhœal joints, suggested to me the open method of treating gonorrhœal epididymitis. The operation employed by me is as follows:

The patient is prepared as for a major operation and then anæsthetized. Cocaine is not practicable because of the pain occasioned in handling the parts after the initial steps. At the juncture of the swollen epididymis and testicle an incision 6 to 10 cm. in length, depending upon the amount of enlargement, is made through the scrotum down to the tunica vaginalis, which is opened

FIG. 1.

FIG. 2.

at the juncture of the epididymis and testicle. After the serous membrane is opened all the fluid is evacuated and the enlarged epididymis examined through the wound. The testicle with its adnexa is delivered from the tunica vaginalis and enveloped with warm towels. The epididymis is then examined and multiple punctures made through its fibrous covering with a tenotome, especially over those portions where the enlargement and thickening is greatest. The knife is carried deep enough to penetrate the thickened fibrous capsule and enter the infiltrated connective tissue. When the knife is through the thickened covering of the epididymis a very marked lessening of resistance will be felt. If

pus be seen to escape from any of the punctures, the opening is enlarged and a small probe inserted in the direction from which the pus flows. By this method I believe there is less danger of injuring the tubes of the epididymis than by cutting with a knife. After the probe is passed in, pus will be evacuated by light massage in the region of the abscess and a fine-pointed syringe is used to wash out the cavity with 1 to 1,000 bichloride of mercury, followed by physiological salt solution. The testicle is then restored to its normal position, and in every case the tunica vaginalis is thoroughly washed with 1 to 1,000 bichloride, followed by normal salt solution. The incision of the tunica vaginalis is lightly closed with a running catgut suture, a cigarette drain of gauze is then applied over the incision, the skin being brought together with a subcutaneous silver wire suture, the cigarette drain passing out at the lower angle of the wound. Silver foil and a sterile dressing are now applied and the part supported by a wide T bandage.

In every case in which I have operated fluid has been present in the tunica vaginalis, varying in amount from a few drams to two ounces; the larger the swelling the greater the amount of fluid. This fluid resembles that seen in gonorrhœal joints, in that it is usually slightly blood stained and contains a varying amount of fibrous material in which are entangled a few leucocytes. The parietal layer of the tunica vaginalis is congested and that portion of the tunic covering the epididymis is intensely congested and seems to be the seat of small punctiform hemorrhages. In one case the whole of the body and globus minor was covered by a false membrane, almost like that of diphtheria, which left a bleeding surface on removal. This membrane is composed of fibrin, a few leucocytes, and cell detritus; no gonococci were demonstrable in the membrane, but were found in the pus collected by puncture of the epididymis. I believe this description is identical with that in gonorrhœal inflammation of synovial membranes. Of the 6 cases operated on, in 3 no pus could be demonstrated, but in the tunica vaginalis of one of these gonococci were present. In 3 pus was obtained and in 2 of the latter cases gonococci were found.

On palpation the epididymis is very much thickened, being more marked in the region of the globus minor. Here it is of stony hardness and, on puncture, blood of almost tarry appearance will exude. The body is infiltrated in the same manner but not

to the same degree. The globus major, in the cases operated on, appeared to be the most involved portion, next to the globus minor, and it is in this latter locality that I have found pus containing gonococci in 2 of my cases. In 1 case there was so much infiltration of the epididymis that the tunica vaginalis was incised at its juncture with the epididymis. The skin and subcutaneous tissue were dissected off the posterior aspect of the epididymis and punctures were made in this region with the expected exudation of blood and pus.

The relief seems to be just as great whether or not pus be obtained, and these results are, I believe, explained by the relief of tension obtained by the multiple punctures of the epididymis, the evacuation of the fluid from the tunica vaginalis, and the drainage referred to in the operation. As has been heretofore stated, the cases operated upon have been of a severe type, with great pain, tenderness, and swelling; one of them, on admission to the hospital, was taking one-half grain of morphia every three or four hours with very little relief. Following the operation, every case was marked by instantaneous and permanent relief from pain, no anodyne being required. The second day after the operation the cigarette drain is removed and the wound redressed, when there is usually noted a small amount of ooze on the dressings. The drainage continues for from four to six days and in a week the wound is healed. The patients have, in every instance but one, been up and walking around, free from pain, by the seventh day. The remarkable feature is the rapidity with which the induration, not only of the epididymis but of the cord, disappears, it being much more rapid than by any other method known to me. The fall of the leucocyte count is rather interesting, the most marked being from 18,600 to 9,000 in forty-eight hours. Along with the decrease in leucocytosis is a parallel fall in the temperature curve and pulse, the temperature reaching normal within thirty-six hours and remaining there, or with a very slight fluctuation, not over half a degree. There have been no cases of infection following the operation, nor have there been any cases of recurrence, atrophy of the testicle, or other distressing sequelæ. I have operated on 6 cases by this method, and while realizing perfectly that no very valuable conclusions can be drawn from such a small series, I believe that the results warrant a further trial of operative

procedure along this line, and that the facts stated fairly justify the following deductions:

1. According to the known pathology, it is a rational procedure.

2. If care be exercised, the danger to the patient is slight.

3. The infiltration of the epididymis disappears more rapidly under the operative treatment than under any other.

4. The danger of permanent injury to the testicle and epididymis is lessened.

5. The patients are absolutely relieved of pain on recovery from the anæsthetic.

6. The systemic symptoms are promptly relieved.

7. Medicinal treatment will usually be followed only by relative relief and perhaps not by a permanent cure, because the infecting agent remains. And therefore the most rational way to do away with this is by incision, irrigation, and drainage.

## REPORT OF CASES

CASE 1. F. V. Aged 22. Admitted to Garfield Memorial Hospital, March 17, 1905. Patient contracted gonorrhœa fifteen days before admission to hospital. Ten days after the onset a left side epididymitis developed. Medical treatment and support were unsatisfactory, the pain demanding large doses of morphia that afforded slight relief. Examination revealed a very acute condition, with great swelling of epididymis and cord, the organ measuring twelve inches in circumference. The scrotal skin was inflamed and œdematous. Operation March 19. Temperature 101° to 103°. Leucocyte count 18,600. The tunica vaginalis contained over an ounce of bloody fluid and particles of lymph. The serous membrane appeared identical with that of gonorrhœal joints. Minute hemorrhages were noted over the epididymis especially. On puncture of the greatly enlarged epididymis tarry-looking blood and fluid escaped, but no pus. Cultures and cover slips were negative for gonococci. Twenty-four hours after the operation the temperature was normal, not again rising above 99.2°, the leucocyte count 12,000, and twenty-four hours later 9,000. Relief from pain was complete and permanent, no anodyne whatever being used. Forty-eight hours after the operation the

drain was removed, followed by a little bloody discharge. Fairly firm palpation of the once exquisitely tender organ elicited no pain. On the sixth day the patient was up and about, free of pain, the testicle being but slightly larger than its fellow. He was discharged on the tenth day, the wound being healed and testicle practically normal in size. Three months later, in the secretion obtained by careful massage of the left seminal vesicle and the left side of the prostate only, spermatozoa were demonstrated. Only the most careful examination would show which had been the diseased testicle.

CASE 2. W. M. Aged 28. Admitted to Garfield Hospital June 29, 1905, with a temperature of 103.4° and a leucocyte count of 14,600. He had had chronic gonorrhœa for six months, and five days before admission an epididymitis began. Before entering the hospital his physician was giving him one-half a grain of morphine hypodermically every three or four hours. Excessive tenderness and excruciating pain rendered examination out of the question. The organ was swollen to a circumference of ten inches. Operation on day of admission. Examination under ether revealed no areas of softening in the epididymis; the skin was red and showed marked inflammatory œdema. The tunica vaginalis contained two and a half ounces of bloody fluid mixed with lymph. Practically the same picture was seen here as in Case 1, except that there was much more lymph deposited over the epididymis and a more generally inflamed condition of the whole tunica vaginalis. The testicle appeared normal, and puncture of the tunica albuginea showed a normal condition. About forty punctures were made in the greatly inflamed epididymis; in the region of the globus minor a few drops of pus, containing gonococci, escaped. The skin and subcutaneous tissue were then dissected from the posterior aspect of the epididymis, and punctures made in this region evacuated a small amount of serum, blood, and pus. The small pus cavities were irrigated with bichloride, followed by salt solution, the rest of the operation being as heretofore described. In forty-eight hours the temperature was normal and the leucocyte count 11,000. The relief from pain was absolute and permanent. From now on the patient's recovery was uneventful, greater time being required for disappearance of the infiltration. He was up and around in ten days. I have been

unable to examine this patient recently, but in a letter he states that there is no atrophy of the testicle and an almost complete absence of a former infiltrated epididymis.

CASE 3. J. P. Aged 36. Admitted to hospital October 10, 1905. He had suffered with epididymitis for the previous two weeks, and medical treatment had afforded very little relief. Since the onset of the trouble he has complained of sweats, chilly sensations, and continued pain in the testicle and back. Examination reveals a very tender and greatly thickened epididymis; the skin is rather tense, but not reddened or œdematous. Operation October 14, 1905. Temperature 100° to 101°. The tunica vaginalis contained one and a half ounces of blood-tinged fluid, in which gonococci were demonstrated, but blood and agar cultures were negative. No pus was obtained from the epididymis on puncture. The relief from pain was instantaneous and complete, and in forty-eight hours the temperature reached normal. He was up and around on the fifth day. On the eighth day, the wound being healed, he was discharged.

CASE 4. J. R. Aged 21. Admitted January 16, 1906. Four weeks previous he contracted gonorrhœa and seven days ago there developed an epididymitis. Medical treatment offered but little relief. On examination the testicle was very painful, the lightest palpation causing great agony. The affected organ was not much enlarged, its circumference being nine inches; the skin was not inflamed, but was slightly œdematous. The epididymis and cord were enlarged and markedly infiltrated. On incision the skin was seen to be infiltrated, and on opening the tunica vaginalis a dram and a half of clear, straw-colored fluid escaped. That part of the tunica vaginalis covering the epididymis was covered with much lymph, and its parietal and visceral layers here were glued together; after these were separated there were seen to be present punctate hemorrhages and very marked general inflammation of the membrane covering the epididymis. Cultures taken on hydrocele agar and cover slips were negative. The epididymis was punctured over the globus major and its body, the result being an exudation of blood and serum, but no pus; but on puncture of the globus minor pus was found. A probe was inserted, and three or four drops of pus were massaged out, then the cavity was syringed out and the wound closed as previously described. Cul-

tures from the pus were sterile, and no organisms could be found on cover slips. The wound was dressed on the second day, there being a slight ooze on removing the drain. Patient experienced no pain after the operation, and convalescence was uneventful. He was walking around, free of pain, on the sixth day. This case interested me as showing no redness of skin, even when pus was present.

CASE 5. W. B. Aged 22. Admitted to the hospital December 15, 1905. He contracted gonorrhœa November 30. A right-sided epididymitis developed in one week, from which he suffered excruciatingly, and on admission his expression was that of one enduring agony. Operation December 16. Temperature 100°. The tunica vaginalis contained one ounce of bloody-colored fluid. The epididymis was greatly congested and swollen; this was punctured about twenty times. Pus containing gonococci was obtained from the globus minor. A membrane of lymph was stripped off from the tunica vaginalis; this had all of the characteristics of a diphtheritic membrane, which upon removal left a granular bleeding surface. He had complete relief from pain after recovering from the anæsthetic. Temperature was normal in thirty-six hours. On December 22 he had no pain; the induration of the cord and epididymis was much less. On December 26, when he left the hospital, the induration had disappeared and there was no pain on palpation.

CASE 6. J. T. Aged 26. This case closely resembled the fourth case, except that no pus or organisms were found either in the epididymis or tunica vaginalis, but the relief was as marked and uneventful. Since the presentation of this paper three other cases have been operated upon, the results being uniformly good as regards relief of pain, lessening of infiltration, and rapid recovery.

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# RENO-RENAL REFLEX. REPORT OF A CASE, WITH REMARKS ON THE DIAGNOSIS OF KIDNEY CALCULUS

By H. McC. Johnson, M. D., of St. Louis

OF the various reflex phenomena produced by renal calculi, none are perhaps so striking as that designated reno-renal reflex. We know that pain on one side of the body may be at some distance from the disease, and that this is notably true of renal stone. A kidney calculus may produce symptoms referred to the bladder, stomach, intestine, or other organs, and may even cause pain radiating to the other kidney; but when we come to the question as to whether the pain may be entirely referred to the other and healthy organ, there seems to be difference of opinion among those who have paid special attention to it. Nor is it at all surprising that we should find opinion and observation entirely opposed from different observers, when we know that the reflex symptoms are so strikingly varied and diverse.

That a stone in one kidney may cause pain in the opposite side of the body without producing any pain on the side in which the stone is located, has been strenuously opposed and cited as a dangerous maxim by Morris, and insisted upon as a conspicuous fact by Guyon, Thornton, and Newman.

Morris says: "So far as my own experience and researches go, there is not a single case which affords satisfactory evidence of symptoms on one side only being caused by a stone in the kidney of the other side;" and adds, "I consider the doctrine of reno-renal reflex, with an absence of pain in the affected kidney as unproved and unsound, and if acted upon in practice likely to lead to very serious and dangerous results, as I have endeavored to show in my Hunterian Lectures."

On the other hand, Thornton says: "It must be borne in mind, however, that most of these symptoms [reflex phenomena] may be present in a case in which no stones can be found, and they may be markedly and constantly referred to one side, whilst the stone is in the kidney on the opposite side, a sympathetic transfer-

ence of pain from a diseased organ to its fellow, which I had frequently observed in the ovary before I had any experience in renal surgery.

To substantiate this, Thornton reports the following case: "In July, 1886, I was asked by a friend, Dr. George Johnson, to see a girl, aged 11, the daughter of a medical man, whom he believed to be suffering from renal calculus, and needing operative relief. The patient was fair, thin, and very delicate looking. On examining her, I could detect a large kidney, but could not define the left at all. All her symptoms were on the left side, and I concluded, as had Dr. Johnson before me, that the left kidney was practically destroyed, and that there was compensatory enlargement of the right one.

"*History.*—Two years ago the urine was noticed to be full of white, slimy stuff, which disappeared under treatment, but reappeared at Christmas, 1885, when she also passed red sand and blood. Just six months before I saw her she had her first attack of left renal colic. Other attacks followed,—one in February, two in March, one in April, two in May, and a very severe one towards the end of June. All were typical of left renal colic, no pain or uneasiness ever being complained of in the right side. I fully agreed with Dr. Johnson that it was a proper case for operation, as did Dr. Coupland, who had also seen the child, and who was present with Dr. Johnson at the operation. Dr. Johnson also agreed with the reasons which I urged in favor of my combined abdominal and lumbar operation, to be hereafter described, being adopted in preference to a simple lumbar incision.

"On August 4, 1886, Mr. Murry administered chloroform, and assisted by Mr. Malcolm I made the usual lateral abdominal incision over the left kidney. The most careful examination failed to detect anything wrong either with the kidney or ureter, beyond a few minute, superficial cysts on the surface of the former. I therefore passed my hand across to the other side of the abdomen, and found that the enlargement of the right kidney which we had detected was due to the pelvis and calices being packed with these large stones, which I show you. I made my usual loin incision, and removed them.

"The patient made an excellent recovery, and remained in good health, having no further trouble in her left side, beyond a

very short attack of colic just when she first began to move about, probably due to some stretching of adhesions in the right side. Concerning this single recurrence, her father wrote that during the attack she would not admit of pain over either kidney or ureter, but that when it had passed off the next morning, she was distinctly tender on pressure over the left lion."

Newman records six cases, in which there is evidence of reno-renal reflex, but in the two following cases quoted by him there seems to be no doubt of its existence:

"D. M., aged 38, had complained for six months of a nagging sort of pain in the right iliac region, which seemed to him to pass upward and lodge in his right lumbar region, where it produced a dull, sickening sensation. It would linger there for twenty-four hours, causing him during the time to vomit, and making him at the end of the attack feel very weak. He had four bad attacks of acute iliac and lumbar pain. Immediately after one of these attacks, the urine was found to contain a quantity of albumen, red blood cells, but no tube casts. In the course of a few days the urine returned to the normal. Frequency of micturition was never a symptom Bel eving the case to be one of renal or ureteral calculus on the right side, the kidney was explored and a ureteral catheter passed from the pelvis of the kidney. Nothing was, however, detected. The patient had complete suppression of urine after the operation, which continued till his death, on the fourth day. The kidneys, examined after death, showed the right one (previously explored by operation) to be healthy, and the left to contain a calculus about the size of a pea in one of the upper calices.

"A very interesting case is reported by Mr. Edmund Owen (*British Medical Journal*, June 8, 1901, page 1385), in which the pain was limited to the right side. The right kidney was explored, with a negative result, and at a subsequent operation a large phosphate calculus (400 grains) was removed from the left kidney."

Since Morris wrote his well-known views, Newman has recorded the two above cases, in which the disease was found in the kidney opposite to the one where the pain was located, and the painful kidney upon complete examination (post-mortem in one case and at the time of operation in the other) revealed a healthy kidney.

While it is generally admitted that pain may be referred from one kidney to the other, and frequently is so referred during the height of renal colic, a pain entirely so referred is not usually recognized, nor is the vast importance of the doctrine in special cases universally appreciated.

My attention was forcibly called to this subject during the past year by this case:

Mr. M. W. R. came under my observation September 3, 1905, feeling well except for a slight dull sensation over the left kidney region. In the summer of that year, considering himself quite well, he had applied for life insurance, and was refused on account of the condition of his urine. In 1898, he contracted gonorrhœa, which seemed never to entirely disappear, as after every intercourse since that time he has noticed a slight discharge. During the summer of 1898, a steady, dull, aching pain attracted his attention, located in the left renal region. At times it was rather sharp, sometimes lasting as long as twelve hours. Two months after the beginning of this, he had a sharp, lancinating pain in the left side, and a few days later passed, *per urethram*, a small stone. A month or two later the attack recurred, and he caught a stone about the size of a pea. In all during that summer he had a dozen or more attacks, but passed no more stones to his knowledge. The pain was always referred to the left side, the patient being certain he had no pain on the right side. Since that summer he has had no more attacks, and has felt well, with the exception of a dull, heavy sensation over the left kidney, which persisted.

Cystoscopy showed the bladder to be normal, save a few hyperæmic areas in its base. Nothing abnormal about the ureteral orifices was noted. The ureters were catheterized, the urine flowing faster from the right side than from the left. Analysis of the separated specimens showed:

Right side,—urine cloudy, s. g. 1,003, some albumen, many pus cells, no blood, no casts, and many diplococci much resembling gonococci, but which on further examination proved not to be gonococci.

Left side, urine clear, s. g. 1,018, and otherwise good, except for a few blood-cells which were regarded as caused by the catheter.

The combined urine was cloudy, s. g. 1,010, and contained much pus.

A second catheterization later revealed the same condition. Nothing could be definitely made out by palpation of the kidney regions.

Although all the history pointed to the left kidney, the condition of the urine as drawn with the catheters indicated that the right kidney was the diseased one.

I opened the right kidney September 18, and extracted about thirty stones of various sizes, some as large as an almond-kernel, many the size of a pea, and much gravel. The calices were filled with stones, evenly distributed throughout the kidney. There was an extensive involvement of the organ in the suppurative process, the kidney being very small and atrophic, with a very little secreting substance. The kidney had to be very nearly bisected to remove all the small stones that were distributed throughout the organ. The ureter was free. A drainage tube was passed into the kidney through the lower pole, and the kidney and wound partially closed.

As long as the drainage tube was in place and the urine from the right kidney passed out on to the loin, that passed through the urethra was almost clear and of good specific gravity (1,018), but as soon as the tube was removed and the urine began to come by the ureter from the right kidney, the urine became again more cloudy from the admixture of the detritus from the right kidney, the cloud being increased or diminished depending upon the amount of material that escaped from the wound in the right loin.

The patient recovered, but a fistula remained in the lumbar regions. As this peristed and a pocket of pus developed about the kidney, I removed the kidney, August 13, 1906. At present (one and one-half years after the operation) he is in excellent health and is free from pain. The urine is normal and the wound has healed. X-ray shows no calculus in left kidney.

Here, then, is a case which presents absolute quiescence, so far as pain referred to the right side is concerned, of an extensive disease of the right kidney, a pyelonephritis of apparently seven years standing, with the formation of many stones. Had it not been for the means of precision which now make it possible to determine which kidney is at least the most diseased, I should,

from the history and physical examination, have operated upon the left and healthy kidney.

In a case of this kind, where the other kidney was not explored, we cannot be certain that there is not also—or has not been—a calculus in the left kidney. It is possible that seven years ago the renal colic was due to the passage of a calculus from the left kidney, and no more stones formed there, but to account for the continual dull ache in the left side, and its disappearance after the removal of the stones from the right kidney, would hardly be possible on this basis. Whether, as Morris endeavors to explain it, the cessation of pain on the side opposite to the one operated upon is due to an accidental shifting of the stone in the painful side—a coincidence that seems to happen too often to be true—or whether the pain was a referred one, cannot be proven beyond doubt.

It may be regarded as established in this case that the right kidney contained numerous stones which never gave the patient any pain on that side, and that what pain he did have on the left side was relieved by the removal of the stones in the right.

It has been urged that there is more reason for referred pains on the same side of the body as the disease than for a pain to be transferred across the body, in that the nerve connection is more intimate from the kidney to the organs on the same side of the body than from kidney to kidney. Whatever this anatomic relation may be, it is universally observed that during the height of an attack of renal colic, pain may sometimes be felt in the healthy kidney, though it accompany the colic in the other kidney. As this pain is sometimes transferred, the anatomic possibility is thus established, and as some of the pain is transferred, it is not unreasonable to suppose that all of it may be, just as in the case of the bladder, when a stone in the kidney may produce bladder symptoms only.

I do not see how we can go beyond the two cases recorded by Newman—in which the painful kidney was proven to be sound, and its fellow contained a stone—and the other reported cases, in which there is no reasonable doubt. It would seem that enough evidence has now been collected to establish the doctrine of reno-renal reflex as a fact; not that it is the usual or customary trend of affairs, but that it does exist, though rarely, and we must be on

the watch for just such freaks of nature. Taken in this light, it would appear that the doctrine is not a dangerous one—not one to be applied in a haphazard way—but one that should be accepted.

If reno-renal reflex does not obtain as a scientific fact, if doubt can be raised as to the cases reported, it is reasonably established that the painful kidney is not always the diseased one, and that mistakes are frequently made as to the kidney most affected. Certainly the wrong kidney has been operated upon sufficiently often to justify us in calling attention to these possible sources of error. With the means that we have at our disposal in these days of accurate investigation, this error should be reduced to a minimum.

And yet, although the X-ray in expert hands has enabled us to locate calculi much more accurately than we could formerly, this positive accuracy is limited to so few that many cases must still be decided upon other evidence. We are informed of the work of precision claimed by expert radiographers, but that such absolute exclusion or demonstration of the presence of calculi in the kidney is the experience of but few may be surmised from the number of failures made even in favorable cases. A uric acid calculus weighing 465 grains, which I removed from the right kidney of a thin patient, had been missed by radiography. So that, while the Röntgen ray is perhaps the best means we have of locating stones, we cannot rely absolutely upon it.

It is not advisable to depend upon the enlargement of the kidney to guide us to the proper organ to attack, because this enlargement is sometimes due to compensatory hypertrophy and may be the only secreting kidney tissue in that individual, as the following case illustrates:

Mrs. L. S., in 1900, was operated upon for abscess of the left renal region, and much pus was evacuated. A fistula remained. When I saw her for the first time in April, 1905, there was a fistula in the left lumbar region, which was discharging a small amount of pus. Some pain could be elicited upon deep palpation, but no kidney could be made out. On the right side, a very much enlarged kidney was discernible, extending several inches below the margin of the twelfth rib.

Ureteral catheterization showed the urine from the right side to be normal, while only pure pus could be obtained from the left

side. Examination of the pus revealed nothing more than the colon bacillus.

May 3, at the St. Louis Mullanphy Hospital, I opened the left loin, and found a small sac of pus and a stone the size of a partridge egg. The kidney was nothing but a fibrous sac, secreting no urine at all, while the fistula was kept open evidently by the calculus. After a somewhat protracted recovery, she is now well and doing hard work. The urine passed thorugh the urethra is normal.

This was a case of compensatory hypertrophy, and if the large kidney had been mistakenly attacked surgically, the result might have been different.

Often it is not so much the fact that a stone does or does not exist as it is which kidney is the diseased one; for if reno-renal reflex exists for stone, it is just as possible to obtain in cases of other surgical diseases of the kidney, conditions in which the X-ray may not be expected to furnish a basis for differentiation.

That it is possible for the painful side to contain the less affected kidney is too well known to need further discussion, and while this differs from reno-renal reflex in that the pain is not a referred one, yet the practical outcome is the same as if the pain were referred, and we must guide ourselves accordingly.

At times, something may be gained from the appearances of the ureteral orifices, but often it furnishes only negative evidence, and here, too, we have to exert care, as they may indicate kidney disease, when nothing beyond the orifice is affected.

The ureter catheter (or segregation) will tell us the state of the urine as it comes from the separate kidneys, and will enable us to recognize obstructions in the ureter, but will not be of much value in the actual diagnosing of stone—not inflammatory products—located in the kidney, further than what may be determined in the way of an obstruction, and can be detected with Kelly's wax-tipped catheter, or Cabot's resonator.

Abdominal incision and palpation is unreliable. In fact, palpation of the kidney without cutting into it has long been known to yield many errors.

Lumbar exploration will be needed for a certain number of cases, but it is just this additional or unnecessary cutting that we wish to avoid.

Thus we may see that while pain in the vast majority of cases is reliable, in a few it is totally misleading, and that, as Keyes has pointed out, there is no one symptom diagnostic of renal calculus disease, but it is by a proper amount of importance being attached to all of the symptoms and methods of diagnosis that we may arrive at a correct conclusion and avoid error in the greatest number of cases.

## THE DIAGNOSIS OF OBSCURE CASES OF RENAL AND URETERAL CALCULUS

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THE importance to the patient and to the surgeon of an accurate diagnosis as to the presence or absence of calculus in the kidney, or ureter, and of the exact location of the calculus when its removal is contemplated, entitles this subject to attention.

Calculus in the kidney, in a calix or a dilated pelvis, may be exceedingly difficult to find at operation, with the kidney delivered and in full view. In such a case, it is impossible often to palpate a stone of the size of a black bean (½ inch by ¼ inch by ¼ inch) through the lips of the hilum, and such a calculus may easily be displaced upward or downward into a calix so that palpation through the kidney substance, or by means of a finger inserted into an opening in the pelvis (which finger-tip cannot be made to enter the calix), may fail to discover it, and splitting the kidney from end to end opening into all calices may, in extreme cases, be necessary. Needling, probing, etc., may also fail.

Calculus in the abdominal ureter, and at the lower extremity of the ureter when in the intramural portion, is quite accessible for removal, while one situated one or two inches above the bladder wall in the pelvic ureter involves an operation for its removal which is classed among the most difficult of surgical procedures.

Even a Kraske mutilation has been proposed for access to this part of the ureter.

If the calculus is not found in the kidney, but an obstruction is found by a ureteral probe passed down from the pelvis, a prolongation of the operation through a second incision for access to this part, or a deferred second operation, is necessary.

To safeguard the patient from unnecessarily mutilating operations and to avoid long and, as has all too frequently been the case, even fruitless search, a definite conclusion as to the site of the calculus should be painstakingly sought before operation is advised.

In many cases it is by no means simple to differentiate infected calculus disease from other diseases of the kidney and its pelvis, such as pyelitis, pyelonephritis, pyonephrosis, and tuberculosis, or from vesical tuberculosis and prostatitis, and the case without pyuria from renal neoplasm and some forms of nephritis or from diseases of neighboring organs, such as cholecystitis, cholelithiasis, pancreatitis, pancreatic calculus, gastric disease, intestinal colics, appendicitis, ovarian and tubal disease.

Typical cases of neophrolithiasis may present features from which a diagnosis is speedily reached, but not infrequently all the means at command must be brought to bear to definitely conclude upon the cause of the symptoms and the site of the calculus.

A calculus in the lower ureter may, and not infrequently does, give rise to subjective symptoms, precisely the same as those caused by a calculus high in the upper pole of the kidney. This fact is frequently overlooked by surgeons who depend upon the history, physical signs, and radiographs of the kidney only, and, finding no shadow after a satisfactory series of plates, conclude that nephrolithiasis can be excluded.

Lumbago, sciatica, chronic appendicitis, peritoneal adhesions, chronic cholecystitis, tubal and ovarian disease are explanations given to patients to help them bear the pains of renal and ureteral calculi because of incomplete examination. Within the past year the writer has seen patients upon each of whom one of these diagnoses has been made, each of whom has borne his suffering for years—some of them have undergone operation—

after which recurrence of the familiar pain has been ascribed to another of the list, usually to the common peritoneal adhesion.

It is the duty of the urinary surgeon to make clear the diagnosis in these cases. This is possible in practically every case. Yet, with all our means of determining a diagnosis, there are cases which are baffling. An outline of procedure is as follows: 1. History; 2. Examination of urine; 3. Physical examination; 4. X-ray examination; 5. Special instrumentation.

*History.*—The main subjective symptoms of cases of suspected nephrolithiasis may be classed, for brevity, under two heads: (1) Pain, and (2) Changes in urination, *i. e.*, disturbance of function and alteration in the character of the urine. Pain may be entirely absent or there may have been, in the past, a scarcely remembered discomfort which lasted but a short time, and these cases lead their advisers to conclude often that, without renal colic, no renal calculus can exist. No one symptom is so deceptive in this condition as the description of pain which patients give. Pain in the spine, weakness of the back, aching in the ilium, lumbago, sciatica, are commonly described, by one as mild, by another as agonizing. The severity and character of pain have doubtless, in great part, a direct relation to the traumatism done by the movement of the calculus or the distention of the pelvis and ureter above a partial or complete obstruction, and the back-pressure produced thereby upon the kidney, which secretes under difficulty and, we may reasonably presume, becomes hyperæmic or congested, with consequent distention of its capsule. A cramp contraction (tonic spasm) of the muscular coat of the pelvis and ureter, combined with traumatism to the mucous membrane, accounts for ureteral colic. This pain is often reflexly felt along the distribution of the ilio-inguinal, genito-crural, and sciatic nerves. The character of the calculus has much to do with the severity of the pain and the traumatism produced. A sharp or rough calculus (as many calcium oxalate and phosphatic calculi) the size of a pin-head, may produce the most agonizing colic, while a smooth surfaced stone, nearly as large as a cherry, may be borne in the pelvis, or ureter, without severe pain throughout life. Either of these may give rise to any of the pathological conditions consequent upon partial urinary obstruc-

tion, such as dilation above it with infection sooner or later, as usually occurs wherever a stasis of urine is found.

Calculus in the kidney, in a calix, or in the pelvis, produces pain which is referred to the kidney region and all along the ureter, which shares in the spasm set up by efforts to expel it from above.

The site of pain (not colic) may be said to be either at the point of obstruction by the calculus or above it, commonly, of course, at the site of the calculus; but, in some cases, this point is neither referred to as the most painful area, nor is there great tenderness on palpation of a calculus. The greatest pain is often referred to the region of the kidney, or along the ureter above the situation of the calculus when it is in the ureter.

Changes in urination consist in disturbances of this function and alterations in the character of the urine. The functional disturbances are painful, frequent, or irregular, imperative demands for urination, or there may be infrequent urination—oliguria; anuria.

Either typical renal calculus pain, or change in urination, and in the character of the urine, may be absent from the history. These cases, in which the two cardinal symptoms are not combined, form a large class, and are frequently told that renal calculus can be excluded. Those who have right-sided pain, without urinary symptoms, are not uncommonly subjected to appendectomy and exploratory laparotomy for examination of the gall bladder and bile ducts, or to search for the wary peritoneal adhesions or, in the female, undergo pelvic operations for purposes of investigation.

Those who complain of disturbance of urination, or show gross changes in the urine, are more fortunate in having attention immediately called to the urinary tract.

The importance of the careful examination of centrifugated urine, when the suspicion of renal calculus has been aroused, has been repeatedly emphasized. The failure to carry out completely this part of the examination accounts for many failures in diagnosis. It is, however, common observation that a renal colic, due to calculus, is accompanied by, and subsequently shows, no trace of red blood cells in carefully examined specimens. This is explainable when a smooth surfaced calculus causes no trauma

upon the mucous membrane and the muscular spasm of the pelvis and ureter has not produced such squeezing of the mucous membrane that rupture, or diapedesis, results.

Calculus situated above the lower pelvic ureter may never give rise to frequent or painful urination, while calculus in that portion near the bladder, especially when in the intramural portion, almost invariably sets up spasmodic contractions of the viscus, such as are caused by prostatic or urethral disease. Renal and ureteral colic may communicate the muscular spasm to the bladder, and calculus disease seems, at times, to cause vesical irritability without recognizable changes in the bladder or in the chemical or microscopic character of the urine.

In purulent urine, of whatever origin, red blood cells are commonly encountered, but are often difficult to distinguish in the fields of pus under the microscope, so that, in the infected cases, a minute quantity of blood is an ambiguous sign. In aseptic cases, however, great significance can be attributed to a few red blood cells found in voluntarily passed urine. The use of a soft rubber catheter may, in the most skillful hands, cause sufficient trauma to the delicate mucous membrane about the sphincter, along the posterior urethra, or upon the floor of the bladder, to show red blood cells in a specimen drawn in this way—consequently, we must place most reliance in the finding of hæmaturia upon specimens passed voluntarily under precautions of cleanliness. In women, this may require a special technique.

There are some who assert that, in many cases, the character (size and shape) of epithelial cells, found in urine, give a definite clue as to the site of a lesion, situation of a calculus, etc. This is doubtless true in cases where a marked preponderance of one type of cells is found, but the opinion of many competent clinical pathologists seems to be that this is rarely the case in surgical urinary affections. Certain types of crystals are said also to preponderate with calculus of uric acid, calcium oxalate, or phosphate, respectively. In looking over some of the reports of others, and of our own, we find that the crystals found in urine often do not at all correspond in nature with that of a calculus present. Phosphatic deposits are as often found in urine where a uric acid calculus exists, as urate or uric acid deposits; and uric acid, urates, and oxalates are found in cases which carry phos-

phatic calculus, so that we are led to question a diagnosis of the variety of calculus based upon the variety of crystals appearing in the urine.

*Physical Examination.*—Physical examination, as ordinarily meant by inspection, palpation, and percussion, gives ample resource for the investigation of the cause and seat of disease, and should be carried out with careful record of the signs which it gives. Yet the history, urine examination, and physical examination, efficiently made, do not afford conclusive evidence of the presence of a calculus and its location.

Localized tenderness is usually elicited when pressure is exerted upon the site of a calculus. A localized point of tenderness will often mislead if it is not clearly recognized that there may be no especial tenderness at the site of the calculus but great pain on palpation over the distended or diseased portion of the tract above the obstruction. When a calculus projects from a ureter mouth into the bladder, it may be palpated by rectum or vagina, touched by a sound or searcher, transmitting the characteristic sensation to the finger and heard by the ear, and also it is plainly visible by the cystoscope.

It is certainly a rare experience for a surgeon to palpate a calculus, or several calculi, in the kidney. Calculus in the abdominal ureter is rarely found on palpation. In very thin, or lax-walled bodies, this is possible at times. Calculus, in the pelvic ureter, is palpable by rectum, in the male, only when lying immediately above or in the intramural portion of the ureter. Between the crossing of the iliac vessels and the vesical juncture, there is an extent of ureter of approximately 10 cm.—nearly 4 inches—which in the male, and in most females, is out of reach of the palpating finger.

*X-ray Examination.*—By this means a positive diagnosis of calculus in the kidney, renal pelvis, or ureter, can be made, for the reason that this, when positive, is a physical demonstration as certain as direct eyesight.

The Röntgen-ray has proved to be of inestimable value as a diagnostic aid, especially for lesions of bones and for the discovery of urinary calculi. It is essential for complete examination when urinary calculus is suspected. Without it, no combination of other signs is convincing—yet it has limitations. Hardly

more demand must be made upon this form of clinical research than is made upon others which are older and whose value and limitations are now recognized by all.

No reasonable physician expects a positive exclusion of tuberculosis because tubercle bacilli are not found in sputum or urine, when signs give weight to this suspicion. So we cannot positively state that calculus does not exist in the urinary tract after several satisfactory plates are obtained of each part of the tract. I believe, after some experience in radiography, that a positive statement that calculus can be excluded, by reason of any X-ray examination, is unwarranted. Fortunately, it is only rarely that the pure uric acid, or urate calculus, exists. I recently saw a large calculus in a bladder by means of the cystoscope, and was astonished to obtain clear plates of the pelvis, showing no shadow which might, of itself, arouse the suspicion of calculus. In order not to judge my own X-ray results as conclusive, this patient was sent to Dr. E. W. Caldwell, and his plates, he frankly stated, would not have led him to make the statement that calculus existed, had he not known of its presence. A very short exposure, with a very low tube, brought out a shadow, which we could recognize as that of the calculus, after its removal by cystotomy. This point is of such importance that a description of this large vesical calculus is given. It is a bi-convex disk, reddish brown in color—measuring 51 by 46 by 22 mm., weighing 42.2 grams—composed of uric acid in its periphery, and uric acid and sodium urate in its center. This, and other experiences, lead me to believe that some cases harbor calculus which have been positively stated to be calculus free.

Some experiments with calculi which had been carefully analyzed, as well as with the pure powders of the various constituents of calculi, give me reason to doubt the possibility of obtaining shadows of calculi composed of uric acid or urates, without admixture of other salts. A uric acid calculus, having a very slight admixture of oxalate, phosphate, or carbonate, or a very thin coating of any of these salts, can be demonstrated clearly.

The plates, which failed to reveal a recognizable shadow of the large calculus mentioned, show the coccyx quite distinctly to its tip, and this calculus covered this bone at the time.

Pure uric acid, sodium urate, and ammonium urate, absorb

very little of the X-ray and give a barely recognizable shadow even when placed directly upon the plate. Most uric acid, and urate calculi, have some oxalate salt in or upon them—often a bare trace only upon analysis—yet this is sufficient to give them resistance to, or absorption of, X-rays and a definite shadow upon a plate.

The X-ray examination, however, in the great majority of cases, is competent to show accurately the size, shape, and location of a calculus in any part of the urinary tract in practically every individual, without regard to size, adipose, or muscular development. In favorable subjects, we should get the shadow of the kidney and be able to determine very accurately the position of a calculus in it, *i. e.*, whether the calculus lies in the pelvis, in an upper or lower calix, or far out in the renal parenchyma. The importance of this accuracy is appreciated when the number of cases in which the search by palpation, needling, probing, and splitting, is carried on, and even abandoned without removal of the object sought.

If the surgical work can be limited to a small part of the kidney, or to the pelvis, without resort to examination first of parts where we can be sure the calculus does not lie, an advantage is gained.

I have recently seen patients who have been subjected to operation during which the calculus was not found after prolonged search, whose symptoms have naturally persisted and in whom the calculus could still be clearly demonstrated upon radiographs.

The deceptive shadows, such as those of phleboliths, calcareous deposits in muscles or tendons, calcareous appendices-epiploicæ or dense material found in the intestine frequently, can be excluded positively. Dr. G. E. Brewer's case of calcareous appendix-epiploica, adherent to the wall of the ureter, is in a class by itself and must exist very rarely.

Several (two or more) plates, taken at different times and at different angles, should always be made before a statement as to the situation of and nature of a body casting a shadow upon an X-ray plate, is made.

This does not involve risk to the patient, so far as deleterious effects from X-rays are concerned, if exposures are short—not over two minutes in all—for several plates, and should involve shorter exposure-time wherever practicable. Satisfactory X-ray

plates can only be obtained when the intestinal tract is practically empty. We should get a shadow of the kidney itself—the normal kidney even—and, in plates of the pelvis, should show the coccyx to its tip as well as obtaining the detail of thick muscle and bone extremities demanded by judges of X-ray plates in order to consider this examination satisfactory.

Because of the impossibility, as I believe, even in small and thin subjects, of showing the presence of the pure uric acid, or urate calculi, by means of X-ray and because of the uncertainty of any combination of symptoms, and in many cases also the baffling evidence, or lack of evidence, elicited by the physical signs, we must resort to special methods for aids in determining the diagnosis.

*Special Instrumentation.*—The data obtained by a cystoscopic examination of the bladder often give very strong evidence of the presence of calculus in the ureter. When hemorrhage, or pyuria, occurs in these cases, we usually have pain as a symptom to guide us to the suspected side and may see the dark or cloudy jet from that ureter mouth.

A calculus projecting through the ureter mouth may be easily seen. A calculus, just within the ureter mouth, gives a marked tumefaction of the mucous membrane all about the mouth of the ureter. A calculus still higher in the ureter, *i. e.*, above the intramural portion, may produce no change visible at the mouth and yet it may be the cause of a hyperæmia or œdema, or protrusion (prolapse) of the mucous membrane, with or without petechial points, because of the frequently repeated physiologic efforts to expel the foreign substance.

Not too much reliance can be placed upon "ureteric meatoscopy" for real evidence as to the condition above the mouth of the ureter. The appearance of the ureteric meatus gives grounds for valuable suspicions—rarely is it evidence.

The catheterization of both ureters at the same time, for the collection of a sufficient quantity (10–30 cc.) of the excretion of each kidney for comparative chemical, microscopical, bacteriological (including cultures) and physical examinations, gives most important data, aiding in determining the pathologic condition of the affected tract and the condition of the other and in pointing to the surgical procedure to follow.

A kidney, irritated by a concretion, seems to be stimulated to great activity (unilateral polyuria)—an effort no doubt to expel the offender when there is an open course through the ureter. Its functional activity also seems to be impaired, for the amount of solids excreted in the urine from such a kidney usually compares unfavorably with that of its fellow.

Abnormal constituents, or a relatively abnormal amount of epithelium, from the pelvis and from the tubules (catarrhal pyelitis) may be obtained from the affected ureter and, while hemorrhage is occurring or if infection has already occurred, blood and pus will demonstrate these conditions.

When nephrectomy is contemplated, the importance of knowing that the other kidney exists and is functionally competent is obvious. To "take the chance" that it is present and vigorous, and then have the autopsy reveal its absence or pathologic condition, is not good surgery.

The necessary time, trouble and discomfort devoted to cystoscopic and ureter examination before operation are amply compensated for when, during a proposed nephrotomy, uncontrollable hemorrhage or an unsuspected condition of the kidney make the removal of the entire organ necessary.

After some experience with the cyroscopy test, I have been led to the conclusion that the determination of the freezing points of the separate renal products gives us no more reliable knowledge of the comparative capabilities of the kidneys than is brought out by the complete chemical and microscopic examinations, which should never be omitted.

*Ureter-catheter as a Probe.*—The ureter-catheter may give strong indications of the presence of a calculus by coming in contact with it in the ureter and being obstructed in its advance upward. This, too, is frequently a pitfall because of the readiness of the catheter to become caught in a fold of mucous membrane, or to fail to follow the course of its lumen because of its stiffness, or too great flexibility. The catheter is at times obstructed by a stricture, which may have no relation to the site of the present calculus. A ureter, harboring a calculus, will very often permit of stretching without pain so that the catheter is easily passed beyond it. This has been done in numerous cases in which calculus has been demonstrated.

It is justifiable to conclude that complete obstruction exists when no jet of urine is seen to issue from the mouth of the ureter during a comparatively long observation, even after hypodermatic injection of indigo-carmine, and when catheters of large and very small caliber refuse to pass beyond the same point and no fluid escapes through any catheter.

Kelly's method of smoothly coating the tip of a catheter with wax and passing it up to or beyond the calculus, so that scratch marks are made into the wax by the hard, rough calculus, is advantageous in many cases, in women especially, with his own method of ureter-catheterization, but it is liable to lead to erroneous conclusions when used in the direct-illumination cystoscopes of European or American design, by reason of impressions upon the wax made by the catheter canals in these instruments. By means of the wax-tipped catheter, in suitable cases and in experienced hands, one of the best evidences of the site of calcareous material in a ureter may be obtained.

The phonendophore (metal-tipped auscultatory ureteral bougie), as devised by several men, has been used by me. It is a promising means of searching a ureter and renal pelvis.

A ureter-catheter, bearing a stylette of metal, preferably soft wire of small size, may be passed through the length of the ureter and, as first done by Dr. F. Tilden Brown in 1898, a radiograph immediately taken to show the course of the ureter. A shadow coinciding with this line is, in most instances, a ureteral calculus; yet here error may be made, for this simply represents shadows falling in the antero-posterior plane of the stylette, and any shadow-casting body lying in that plane, from the skin of the adomen to the skin of the back, may be mistaken for a calculus in the ureter in contact with that stylette. This error can be almost certainly avoided if stereoscopic radiographs are taken of the styletted catheter in the ureter.

When the calculus obstructs the passage of the catheter through the ureter, or lies in the renal pelvis, the radiograph should show the shadow of the stylette extending up to the obstruction, giving by measurement its distance from the ureter mouth and, by its relations to the body structures shown in the radiograph, an accurate estimate of the point to be attacked surgically.

The distention of the renal pelvis, through a ureter-catheter by injecting fluid until pain is produced, for the purpose of determining whether the subjective sensation of the patient is the same as, or a different experience from that of the attacks from which relief is sought, is not commonly employed, but, at times, has given important additional evidence in doubtful cases. It is occasionally valuable for evidence in making a differential diagnosis from extra-urinary pain.

These details of methods, with some of the weaknesses of each, would seem to make the diagnosis of obscure cases of renal and ureteral calculi not only difficult, but tedious and complicated, and (some will say) in the end leading to no more definite conclusions, so that exploratory operation will be the outcome after all. This may doubtless be true in a very few cases. The condition in the urinary tract, which fails to be revealed by such an examination, must be rare indeed. And so, in these same cases, exploratory operation will as frequently fail to remove and fail even to reveal the cause. The frequency of exploratory operations in this country appears to me a blot upon American surgery. The usual physical examination, cystoscopy, collection of sufficient quantity of secretion from each kidney, examining the lumen of the ureter, and radiograph, while a styletted catheter lies in the ureter, can all be accomplished at one visit within the space of one hour, with the proper preparation of the patient and the necessary facilities at hand. It is preferable, however, to divide the examination into two or more parts, making the physical examination and cystoscopy at one time, with the ureter and X-ray tests subsequently.

The baffling cases in which a diagnosis cannot be made—so far as our present methods go—are those in which a smooth, pure uric acid, or urate calculus, exists without obstructing the flow of urine and without infection. These patients have pain, and we suspect the urinary tract, or they have painless hæmaturia, yet we cannot demonstrate positively the presence, or absence, of calculus. It is, we believe, a rare condition.

I take this opportunity of expressing gratefully my indebtedness to Dr. F. Tilden Brown, with whom I am associated, for opportunities to see many of his cases and for the use of his records in the study of this subject.

# ILLUSTRATIVE CASES OF PROSTATIC CARCINOMA

By J. Bentley Squier, M. D., of New York

A CRITICAL study of recent literature of malignant neoplasms of the prostate produces the impression that carcinoma of the prostate, along with carcinoma in other situations of the body, is notably upon the increase. In the past it has been considered an extremely rare occurrence, although recognized to be the usual variety of malignant growth of the gland. The fallacy of this doubtless lies in the poorer methods of diagnosis of a decade ago and the comparative infrequency of surgical attack upon the organ prior to that period. Thus many cases of prostatic carcinoma have probably been diagnosticated under the generic term of enlarged prostate which, if their true structural nature had been investigated, would have proved to have been malignant. Such an observer as Albarran has demonstrated carcinomatous changes in from 10 to 14% of cases of prostatic hypertrophy. The impetus which operators during the past few years have given to prostatic surgery in their attempts to alleviate the suffering due to urinary obstruction, coupled with more accurate microscopical diagnosis, have probably been the potent factors in the production of the seeming increase of the disease. At all events, the prostate is one of the rarest localities for carcinoma to become manifest. In 1,000 cases of carcinoma in various situations Weber found only 13 involving the urinary organs. Even in the reported cases the diagnosis, in many instances, is still doubtful because of the possibility of confusing hyperplastic growths with true carcinoma.

Prostatic cancer presents itself at the two extremes of life, namely, in early childhood or in advanced years. About four-fifths of all malignant growths of the prostate are carcinomatous. There is a diversity of opinion as to the relative frequency of the growth being primary or secondary in the prostate. Not infrequently tumors are described as primary, when the origin is really from the epithelium of the bladder, the growth invading the gland secondarily. We believe it is more often primary than is ordinarily supposed, and develops either in the mucosa of the pros-

tatic urethra, diffusely through the entire gland, or may form a discrete nodule in one portion of it. The process may be of the medullary type, or show the structure of adenocarcinoma. In regard to extension to other organs, Guyon claims that carcinoma, which is primary in prostatic origin, is more liable to invade the pelvic lymphatic system than to extend directly to the bladder. If the growth invades the bladder it is along the ejaculatory ducts into the posterior wall. Extension into the pelvic tissues and viscera, with final invasion of the bones of the pelvis, is met with only in late cases. When once the bone is involved the tumor may assume a diffuse form and involve a considerable portion of the pelvis, the vertebral column, and the long bones of the lower extremities. Exceptionally, the entire skeleton may be involved even when the primary growth is relatively small. Secondary carcinoma is usually due to an extension of a renal, vesical, or genital lesion. The cases which I have selected to report in this paper, although very characteristic, embody certain features of special interest, which, I think, justifies a more or less detailed presentation of their histories.

CASE 1. This patient, who was 80 years of age, had been an invalid for many years, suffering from a large, right-sided, irreducible, inguinal hernia. Although incapacitated on account of the size of the hernia, there had never been any obstruction of the intestinal function. He denied any venereal or previous urinary history. The condition presented itself as follows: He awoke one morning, and to his surprise found his bed-linen and night clothes saturated with blood. He found the source of the hemorrhage to be from the meatus of the penis. He stated that at no time had he ever observed blood in the urine or exuding from the meatus. The interval of urination had been every four hours during the day and about the same at night. The urinary flow had always been free and absolutely painless. The only symptom was the hemorrhage. Spontaneous urination was impossible. He was a large, plethoric man, and unusually well preserved for his years. Physical examination was negative, except for a greatly distended bladder, the fundus of which reached almost to the umbilicus. By rectum a hard, diffusely enlarged prostate could be felt. A soft catheter drew 10 ounces of blood and urine. Local measures failing to check the constant ure-

thral oozing, suprapubic cystotomy was decided upon. This was performed six hours after the initial bleeding occurred. The bladder was found distended with blood clot, which, being evacuated, a hard, nodular mass was found involving the whole of the prostate. The hemorrhage emanated from an ulceration on the left side of the tumor near bladder base. The patient's condition, on account of the large amount of blood already lost, did not warrant any extensive operation for the tumor's removal, so the bladder was merely packed and drained, no attempt being made to enucleate the tumor. He required infusion while on the table, and left the operating room in grave condition. He recovered from the operation in much better condition, however, than could be expected. During the first day he drained 30 ounces of urine through the tube in addition to the amount which leaked into the dressing. His highest temperature was only 100.4° F., with a pulse of 80 and respiration of 22. He held his own for two days, when uncontrollable vomiting of bile-tinged fluid set in, and he died suddenly four days following operation, apparently from exhaustion. There was no hemorrhage after the bladder had been opened and packed.

The autopsy findings, which were most unlooked for, in view of the fact that the patient had presented no symptoms referable to some of the lesions found, were as follows: Heart, normal; lungs, a few adhesions at base behind; liver increased in size; Spigelian lobe showed a thick layer of pus and fibrin, forming superior boundary of an abscess cavity; gall bladder distended, contained numerous gall-stones; its surface covered with inflammatory exudate, with marked thickening about common, and cystic ducts forming part of the abscess wall. Duodenum: An inch and a half from pylorus on posterior surface were two ulcers, with clean-cut edges, communicating with the abscess. The uncovered portion of the duodenum was covered with plastic exudate, and formed last boundary of the abscess. The abscess contained 2 ounces of pus. The prostate was large, hard, and from the left lobe sprung a papilomatous ulcerated growth. Pathological examination showed the tumor to be carcinomatous, with deposits throughout the whole prostate.

Lôwenheim has reported a case of sarcoma of the bladder with metastatic sarcomatous gastric ulcers, but in the case just

cited the writer is led to believe the dual condition a coincidence. The duodenal ulcers presented no anatomical or microscopical evidence of being malignant in character.

Sudden hemorrhage from the bladder, especially if unattended by pain in a man over 50 years of age, who gives no history of previous bladder trouble, is most indicative of prostatic cancer. In purely vesical growths pain is more apt to be an early accompaniment of the hæmaturia, obviously depending somewhat upon the location of the neoplasm. In Young's series of 40 cases, however, he states hæmaturia present in only 8 cases, in 4 of which the bladder was involved as well.

CASE 2. This, like the preceding, is another one in which sudden hemorrhage from the bladder first directed the attention of the patient to his malady. He was 54 years of age, and in his own estimation never enjoying better health. While on a railway journey he felt a desire to urinate. This he tried to do, but was unable to for ten minutes, when, with a gush, he voided a large quantity of blood clots and bloody urine. This was followed by frequent urination of bloody urine for twelve hours and a slow cessation of the hemorrhage. The only previous history of any urinary disturbance consisted in two attacks of frequent urination and burning in the perineum, one following a long horseback ride and exposure to cold ten years before, and the second, five years later, after a tedious donkey ride in Egypt.

After the initial hemorrhage had cleared up, the patient would void bloody urine only at intervals, usually worse at night. Not having any pain, he did not become alarmed about himself until the symptom had existed for two months, when he came under our observation. Cystoscopy, which was performed with difficulty on account of the size of the prostate and bleeding, demonstrated a bleeding tumor projecting from the right lobe of the prostate. Suprapubic opening of the bladder and removal of the tumor was decided upon. This was carried out some days later. A sessile tumor was found springing from the prostate, near the base of the bladder, with nipple-like projections into the trigone. The prostate, tumor, and its projection were removed by extensive blunt dissection, and the base of the bladder was cauterized by the actual cautery.

Subsequently to the operation the patient did well for twenty-four hours, when he developed intestinal paresis and died from peritonitis at end of the third day. It was impossible to obtain a general autopsy, but the pelvic viscera were examined after death through the suprapubic incision, and no macroscopical extension of the growth into them noted. Sections of the prostate, tumor, and projections of it into the trigone proved to be carcinoma.

One of the most distressing features of prostatic neoplasm is that the growth has advanced to an almost inoperable extent before it becomes manifest to the patient by subjective symptoms.

CASE 3. This case furnishes a typical illustration of what has just been mentioned. When first seen the patient stated that for several months past he had been obliged to urinate frequently day and night, had paid no particular attention to it, and it was only at the solicitation of his wife that he consulted a physician. When examined he was urinating every two hours, with smarting pain in the glans and at times a little blood in the urine. Per rectum a moderately enlarged prostate was felt, with no tenderness in it excepting in the posterior lobe, where he complained on the slightest pressure. Examination of urethra or bladder was impossible on account of the exquisite pain produced when an instrument touched the prostatic urethra. Expectant measures were instituted, and after a few days, his general condition becoming worse and the patient demoralized about himself, he was given an anæsthetic, with permission to open the bladder if, after examination, it was deemed advisable. A searcher introduced into bladder, requiring marked depression of the handle to do so, was obstructed in rotation by a large mass in the right lobe of the prostate. It was decided to open the bladder and ascertain the pathological condition present. A large mass of carcinomatous tissue was found occupying the prostate and base of the bladder, and surrounding the internal meatus. It was inoperable. The bladder was drained by Gibson's method.

Sections removed for microscopic examination proved to be carcinoma. The patient died at the end of two days from peritonitis, probably due to colon bacillus infection. Whether this

tumor was primary or secondary in the prostate is impossible to know.

The rapidity of the growth of prostatic cancer is dependent, as elsewhere, upon its structural composition.

CASE 4. Scirrhous carcinoma of the prostate. The patient was 62 years of age. For two years before coming under observation he had gradually increasing feebleness of stream, hesitancy, frequency, and nocturnal urination. No pain until these symptoms had existed eighteen months, when intermittent hæmaturia appeared. The relation of the symptoms was not constant, the pain, blood, or frequency occurring independently of each other. The pain was referred to the glans penis and perineum. By rectum the finger palpated a large, broad, elongated prostate, the middle lobe of which was very hard as compared with the rest. Toward the apices of the lobes were hard, irregular nodules. Urethral length, 8¼ inches; 10 ounces of residual urine. The bladder was opened by suprapubic incision. An irregular, friable tumor was found involving the prostrate and surrounding the internal orifice of the urethra and extending into the prostatic urethra. The whole of the prostate was removed, together with the neoplasm. The morphological appearances of the tumor showed it to be largely composed of connective tissue, with diffuse inflammatory infiltration with pus cells. A number of the fragments contained strands and masses of epithelial cells not arranged in regular groups. The patient did well, and for some months after operation was as comfortable as if he had had merely a prostatectomy performed for simple hyperplasia; but slowly the lesion reasserted itself, the extension being into the urethra. X-ray treatment was used with no benefit, and ten months after operation, when he was lost sight of, the only comfort he could get was by frequent recourse to opiates.

CASE 5. This is a case in which the writer removed a scirrhous carcinoma of the prostate, the patient living a year. Permanent suprapubic drainage was instituted at time of operation, and the patient enjoyed a measure of comfort until recurrence of the growth filled the pelvis and obstructed the rectum. In this case also X-ray treatment seemed to have no effect upon retarding the growth.

In reviewing our experience and that of others, the futility of our endeavors to do more than palliate the patient's sufferings by operation is only too apparent.

The whole question resolves itself into one of early diagnosis and operation if we are to accomplish any lasting results. If the steadily increasing number of reported cases prove carcinoma to be suspicious in a tenth of cases of prostatic enlargement, we must be more acutely on the lookout for it. As we have come to regard the smallest tumor in the breast as a possible focus of malignant trouble, and hesitate to pass judgment upon it until microscopical sectional diagnosis has aided us, so ought we to hesitate in pronouncing enlargement of the prostate to be simple hyperplasia until it has been so proven by the pathologist. The early recognition of carcinoma in any locality is imperative, and nowhere more so than in the prostate. Unhappily, this is a very difficult problem. The cystoscope may reveal merely an increase in size of the gland, while beneath its firm capsule an insidious destroyer of life is forming, only to burst forth into too certain cognizance when we are impotent to remove it. It is a sad commentary that practically our operative endeavors are only directed towards rendering the remainder of the patient's life more livable. The majority of patients, if the disease is at all advanced, live longer if palliative measures are employed, than by extensive radical operation. Permanent suprapubic drainage has, in our hands, given the greatest comfort to the patient.

Watson offers bilateral lumbar nephrostomy and the establishment of permanent renal fistulæ, with or without removal of the tumor, as the case may allow, for relief of vesical malignant disease. This might include similar disease in the prostate, as the conditions are so intimately allied. We fail to see the improvement in this oversuprapubic drainage, except in such cases as permit total removal of the tumor, or unless it can be proven that the diversion of the current of urine inhibits the rapidity of the extension of the growth.

Young's 4 cases of removal of the entire prostate, seminal vesicles, vasa deferentia, and major portion of the vesical trigone for prostatic cancer, are brilliant results, and illustrate how well a small amount of bladder left behind will adjust itself to per-

form the function of the intact organ. As we have learned in dealing with carcinoma elsewhere, radical cure can be only hoped for by early operation and wide removal. The symptoms offered by the patients are not pathognomonic, and the results of our physical examination often leave us in doubt as to the true nature of the disease. It seems, therefore, that the only line of surgical advance points clearly to the fact that in operating upon any hypertrophic condition of the prostate, we should make use of the additional data derived from microscopical examinations of frozen sections at time of operation in order to determine the extent of our operative procedure.

# Theses Presented by Candidates for Admission to the American Association of Genito-Urinary Surgeons, 1907

## THE VALUE OF PALLIATIVE OPERATION FOR CANCER OF THE BLADDER

By Hugh Cabot, M. D., of Boston

OF late years the attention of surgeons has been directed particularly to the possibility of radical cure of tumors of the bladder. By the timely and skillful use of the cystoscope these conditions are being diagnosed not only more frequently, but at an earlier stage in their growth, and the chance of radical cure, even of the most malignant varieties, has held out attractive possibilities. There are, however, a considerable group of cases in which it is evident at the time they present themselves that radical cure will be impossible, and the question arises in how far it is possible to alleviate the condition of these patients by operation. Should operation be proposed as a palliative measure, or would such attempts be likely to render the condition of the patient more deplorable? Although palliative operations for this condition have been done for a great many years, it seems as if the tendency of modern surgical opinion was against such interference. Many writers upon the subject of tumor of the bladder have failed to record their views upon this point, but there is a considerable mass of opinion accessible. In this paper I propose to show what this opinion is, and then to present some clinical evidence bearing upon the subject.

At the ninth session of the Association Française d'Urologie, in 1905, a very distinguished gathering of urologists discussed

the subject of tumors of the bladder. In the course of this discussion many of them expressed their views upon palliative operation in malignant disease, and there was considerable unanimity in discouraging such attempts at relief.

Raffin, in a voluminous article upon which the discussion was based, referred to palliative operations as follows: "It is also necessary in order to estimate the value of palliative operations to take into consideration the relief of pain, and the improvement in general condition which destruction of the growth or physiologic side-tracking of the cancerous organ brings about. The benefit which the patient receives is, however, variable, and although most writers do not refer to the subject, it cannot be doubted that the condition of these patients with cancer is sometimes made worse by an attempt at a radical or by a palliative operation."

Weinrich of Berlin, in the discussion which followed, stated that Dr. Nitze at that time held the following opinion: "It is better to consider these malignant tumors as '*noli me tangere*,' since the patients who survive operation are not afterwards in a better condition than they were before.

Malherbe said: "Epithelioma of the bladder, when the diagnosis is clear and when the tumor has existed for some time, should not be operated upon except to check very serious hemorhrage or to relieve excessive pain."

Albarran said: "Palliative operation deliberately undertaken is indicated in very exceptional cases for hemorrhage, more frequently for infection of the bladder or for pain. According to the case, it is liimted to a simple cystotomy or a curetting or a cauterization of the tumor. As a rule, I am becoming more and more conservative in fixing the indications for palliative operations."

Escat said: "I admit but one indication, pain. Hematuria is almost never immediately threatening in cancerous infiltration of the bladder. It can be mastered, as a rule, by the inlying catheter and aspiration of clots. The most painful form of death which menaces patients with cancer of the bladder is not hemorrhage, nor infection, nor cancerous cachexia, but above all, a spreading of the cancer to the neighboring organs, or secondary cancer of the stomach, vertebral column, or intestines. I have

seen some months and some weeks of general improvement due to drainage of the bladder, dearly bought by a perforation of the intestine and the passage of feces through the abdominal wound. Pain is the only indication which should force our hand. I have operated twice to relieve pain. In the first case I got a month of great improvement, but in the third month an enormous fungus developed at the neck of the wound, the tissue between the bladder and the intestine became gangrenous, and the pain was terrible. In another case I opened the cancerous bladder in a woman who had a dermoid cyst which had become cancerous and evacuated itself into the bladder. Here again, if the pain was in part reduced, the situation of the patient became more painful on account of the extension of the neoplasm to the abdominal wall and perforation of the intestine. I prefer to depend upon morphine alone as a palliative measure."

Legueu said: "Total removal of the tumor with resection of the bladder wall is, it must be confessed, very often impossible. The operation is therefore limited to a curetting. Is this operation necessary? I do not think so, and unless a severe hemorrhage immediately threatens life, I think it is wiser to abstain in the great majority of cases when one is quite sure that the tumor is malignant, has a wide base, and is therefore not radically removable. I have become less and less willing to interfere with cancer of the bladder."

Desnos said: "Intervention in this period (second period) is not, in my opinion, justified, except when life is in immediate danger from profuse hemorrhage, grave infection, or terrible pain. Are these symptoms always present in the second period? It is far from the rule. In most cases, hemorrhage is intermittent with considerable intervals showing that the disease is still there, but in the interval health remains perfect. This condition may last for a long time. I have seen several cases in which the local condition did not change in six or seven years, and in which the general health was little or not at all affected. Even better, there are occasional cases in which the tumor retrogrades and, whether on account of a spontaneous throwing off of pieces by the urethra or in a very gradual manner, the tumor slowly becomes reduced to a sort of stalk, which itself slowly disappears. It does not seem to me rational to operate on a tumor of which it is known that a

complete removal is impossible, and of which the evolution on the other hand may be extremely slow and which may exist without interfering with the general condition, but the delay should be, so to speak, an armed one. The surgeon should be ready to act. The indication comes with an increase in frequency and amount of blood and in infection, and especially in pain, whatever the cause may be, whether referred to the abdominal wall or due to the existing cystitis. The operation, although palliative also, gives immediately good results by putting an end at once to pain. It may be possible to go further. By removing the tumor as completely as possible its progress is generally arrested and a recurrence may be postponed for some time.

"In the third period, when troublesome symptoms are menacing, it is also justifiable to operate, and the relief given to the patient may be considerable.

"Of course we are not talking of operating upon the patients in the extremes of cachexia, but it is possible to operate upon patients in a much exhausted condition, depressed by repeated hemorrhages, by severe pain or by infection of the bladder, even if this has extended to the upper urinary passages.

"I have myself been an actor in some true resurrections as a result of cystotomies done in these conditions. It is only necessary to compare the terrible pain caused by the cystitis of cancer with the peaceful condition which appears a few hours after an opening has been made in the bladder to be convinced upon this point.

"The operation properly done remains a purely palliative one, and consists practically in the opening, almost always suprapubic, of the bladder, the picking up of the bladder wall and its suture to the skin.

"The formation of this opening above the pubes is the operation. Of course if a surgeon finds projecting pieces or a pedunculated growth which can be easily removed, it is wise to relieve the bladder in this way, but to attempt to do a classical operation for removal of cancer of the bladder is to expose the patient to an improper risk.

"The suprapubic opening frees the bladder from its constant distention and allows the infected urine to flow out freely. An improvement in the condition of the upper urinary passage re-

sults, and restoration of the proper function of the bladder reacts upon the whole organism.

"The same is true of the local condition, and it seems as if the progress of the tumor was at times arrested, when not irritated by the constant retention and vesical infection. The phenomenon is comparable to the checking of the growth of cancer of the rectum after making an artificial anus.

"Hematuria frequently diminishes, although this is the symptom which seems to be least influenced by the cystotomy.

"This operation, to my mind, constitutes the great resource which we have to relieve these sufferers from new growths. It is above all an act of humanity. It prolongs life, but, above all, it gives their last days comfort, and frequently the suggestion that cure may result."

E. Hurry Fenwick, in his book on *Clinical Cystoscopy*, in 1904, page 321, says: "A radical operation, or even a cystoscopy, should not be advised in any case in which an infiltration can be felt *per rectum;* all such cases to be left rigidly alone. If the patient suffers from the terrible distress of an occluded vesical orifice, then suprapubic drainage is the best that can be done. If the cystoscope shows evidences of sessile infiltrating growth or of sessile bald carcinoma, and yet no infiltration be felt by rectum or vagina, it is best, in my opinion, not to operate unless forced to do so in order to relieve blockage of the vesical orifice or to check dangerous hemorrhage."

These opinions are almost unanimously unfavorable, and though they may not truly represent modern surgical opinion, they cannot, on the other hand, be treated lightly, and must carry weight.

After considerable search I have only been able to find two opinions favorable to palliative operation.

Pasteau, in discussing the paper of Raffin, previously referred to, said: "In reference to sessile malignant tumors the prognosis is therefore much worse. Does that mean that they should not be operated upon? Evidently not. An operation wisely carried out and carried far enough, without pushing it too far, may be of benefit. Furthermore, even when all hope appears gone, when hemorrhage and infection have weakened the patient and made the end appear near, it is possible to postpone the fatal

issue, to check the hemorrhage, to diminish pain, to improve the conditions due to infection, by drainage of the bladder by suprapubic route. I have reported 2 cases of my own. I could also report other observations on patients whom I have followed without having operated upon them myself. But one precaution is necessary. In these operations undertaken to save life, one must not be too radical. No attempt should be made at a radical removal of the tumor. The surgeon should know how to limit his operation. Cure is impossible. He should be content to open, drain, clean, and disinfect. In this way unhoped-for results may be obtained."

Keyes, in his *Text Book of Genito-Urinary Diseases*, in the 1905 edition, said: "Palliative suprapubic cystotomy is the operation suited to all desperate and incurable cases. Even though no pretense is made of eradicating the disease, the patient's life is prolonged by the very fact that he is relieved of his worse symptoms. I have at present under my care a striking example of the value of this operation. Before operation the patient weighed 120 pounds, and was tortured day and night by insistent straining. Within six months after operation he gained twenty-five pounds, although the tumor, which was only curetted, was a typical villus carcinoma."

To these published opinions may be added the unpublished opinion of A. T. Cabot, "that palliative operation in cancer of the bladder may be of considerable benefit in relief of pain and prolongation of life," and the fact, of more value than any opinion, that he has for some years, and still is, operating upon many of these cases. Moreover, many general surgeons who see many of these cases in the course of years frequently do palliative operations and are satisfied that they are of value.

It is clear that the burden of proof in this matter rests upon those who would advise operation. They must show that the patient's condition can be distinctly improved, either by prolonging life with relief of symptoms, or by the relief of symptoms without any lengthening of existence. It would clearly be improper to advocate an operation which prolonged life unless the additional time was made reasonably comfortable.

Upon the basis of these indications palliative operation might be advised in two classes of cases:

I. Those in which it can be undertaken early, before infection has taken place or become important, and in which there is, therefore, the possibility of actually prolonging life.

II. Those undertaken after extensive infection has occurred and which must be regarded as purely for relief of symptoms.

## CLASS I

In these cases the attempt may be deliberately made to influence the course of the disease, though it is admitted at the outset that a radical cure is impossible. The belief that this may be done has apparently been based upon the well-known fact that cancer of the bladder grows slowly and metastases are slow in forming.

In how far such hopes are justified I shall attempt to show by the citation of cases, but wish, first, to outline briefly the method which appropriate cases should be selected and the limitations which surround such an attempt.

Cases appropriate for early palliative operation should show the following favorable conditions:

I. The disease should be in a comparatively early stage, though the location or depth of infiltration make radical cure impossible.

II. Infection of the bladder must be absent or trivial.

III. Infection of the upper urinary tract must be absent.

IV. Cases in which the disease is known to have extended beyond the limits of the bladder and involved the lymphatic glands will not be benefited.

These limitations are necessary because in order to obtain reasonable benefit from operation beyond relief of urgent symptoms prompt closure of the wound must be obtained; for the creation of a fistula at this stage only makes the patient uncomfortable and is not indicated.

Very extensive involvement of the bladder wall, especially if the growth approaches the region through which the suprapubic wound is made and is complicated by infection, is very apt to make closure of the wound impossible. On the other hand, extensive involvement of the base of the bladder or a tumor of large size springing from a comparatively small base may be successfully dealt with.

Severe infection of the bladder, such as is frequently spoken of as a "dirty bladder," makes the closure of any wound slow, no matter for what purpose it is made, and it seems as if infection of this kind made the growth of the tumor more rapid.

Infection of the upper urinary tract makes the patient " a bad risk." This condition is often hard to demonstrate in the presence of bladder infection, but kidney pain, attacks of fever of irregular type and without symptoms, and dilatation of the ureter, as seen by the cystoscope when this is possible, are very suggestive.

While it is in many cases impossible to demonstrate with scientific accuracy that the tumor is or is not confined to the bladder, the occurrence of pain at more or less distant points, evidently due to pressure upon nerves, should be taken as a warning. Pain in the thigh, groin, hip, sciatic region, or upper part of the back is generally due to metastases with pressure upon the nerve trunks. Such pain will not be relieved by operating upon the bladder tumor, and the attempt will bring nothing but discredit upon the operation.

The limits of this paper are such that the methods of diagnosis of these conditions cannot be considered in detail. Careful physical examination, always including rectal palpation and cystoscopy, will enable the choice to be made, and we must insist that each case be studied separately, with a view to determining as accurately as possible the type of tumor, its extent, situation, and complications, not forgetting to estimate the general condition of the patient and his probable resistance to operative trauma.

### CLASS 2

By the previous division of the subject this class contains only those cases in which operation is undertaken purely for the relief of symptoms and not, as in Class 1, with the hope of influencing substantially the course of the disease. The operation is necessarily limited to simple cystotomy, and the end in view is to relieve the bladder of constant distention and contraction and put the parts at rest. The principal symptoms requiring this operation are pain, generally accompanying urination, excessive frequency, excessive hemorrhage, or severe infection. There are

a certain number of cases which will fall between Class 1 and Class 2. In these it will clearly be impossible to influence essentially the course of the disease, and yet the symptoms are not such as to require immediate relief. Under these circumstances it is generally wiser to postpone operation until the symptoms are such as to require a permanent urinary fistula. It is at best a choice of evils.

Having thus briefly stated the limitations which seem to me necessarily surround our attempts to benefit these patients with cancer of the bladder, I submit the following cases as tending to throw light on the question.

My best thanks are due to Drs. M. H. Richardson, F. B. Harrington, S. J. Mixter, A. T. Cabot, and J. C. Warren, for permission to use their cases.

CASE 1. S. H. T., 53; January 9, 1895; Dr. S. J. Mixter. Six years ago slight scalding and increased frequency of micturition. One year ago hematuria began, intermittent, not profuse, no clots. Some straining during micturition, worse when urine clear. Of late considerable blood clots. Frequency, every half hour at night. No loss of flesh or strength.

Examination negative. Hematuria only abnormal condition.

January 11. Operation. Suprapubic cystotomy shows tumor as large as a mandarin orange, soft and friable, on the posterior wall. Tumor removed with forceps and curette. Bladder drained with rubber tubes.

Pathologist's report: Cancer.

February 1. Urine clear, wound nearly closed.

February 25. Wound closed; empties bladder freely.

April 30, 1896. Since leaving hospital has been constantly at work as a sea captain. Well until three months ago, when slight hematuria returned. At present time some suprapubic pain, slight burning, urine smoky.

May 6. Operation. Suprapubic cystotomy shows large papillomatous growth on the anterior wall. Removed with scissors and curette. Distinct infiltration of bladder wall.

Two days later gauze removed, catheter drainage substituted.

May 23. Wound closed.

June 9. Catheter removed. No leakage. Discharged.

June 23, 1897. Patient has been at sea since discharged.

Slight hematuria returned five months after operation, but has not been troublesome. Now has occasional discomfort at neck of bladder, but is in excellent condition.

June 25. Suprapubic cystotomy shows a papillomatous growth projecting from the lower posterior wall. Removed with curette. Gauze packing to control hemorrhage. Gauze removed day following operation, suprapubic siphonage substituted.

July 1. Put on catheter drainage.

July 8. Urination every two to three hours. No leakage.

July 23. Wound entirely healed.

April 24, 1900. Much relieved by last operation. Last few months increasing frequency of urination and during the last few weeks has felt pressure on the diaphragm and difficulty in taking a long breath, occasional sharp pains through left side. Micturition every hour day and night. Urine smoky. Found to have a large cyst occupying greater part of the left side of abdomen. This was tapped under cocaine. Twelve pints of fluid removed. Proved to be an enormous hydronephrosis.

March, 1901. Re-enters hospital. Tumor has been tapped and refilled several times. Patient losing ground.

Died a few months later.

CASE 2. J. D., aged 58; December, 1900; Dr. A. T. Cabot. Fifteen months ago said to have caught cold. Had a chill, with hematuria, which lasted three or four days. During the following eight months had a recurring hematuria every two to three weeks lasting two or three days.

Six months ago, urine clear, health excellent.

Five months ago recurrent hematuria, thick foul urine, chills.

Since that time has had many short attacks of hematuria, with intervals of health between. Urine has at times been clear. Last four weeks urine constantly bloody with clots. No frequency of micturition until last four weeks, during which time he has had frequency of every two hours in the day and three or four times at night. Two attacks of retention, apparently due to clots.

Examination negative, except for tenderness on deep pressure above the pubes and rectal examination, which shows prostate slightly enlarged and very hard. Urine constantly bloody. Examination of sediment shows cells which are thought to be from cancer.

January 3, 1901. Operation. Suprapubic cystotomy shows a soft papillary growth on the left side of the bladder on the posterior wall. Removed with forceps and base cauterized.

Infiltration of base not well marked. Bladder wound snugly closed around drainage tube.

Pathologist's report: Papillary cancer.

Urine clear shortly after operation. Wound closed in three weeks.

July 10, 1902. Urine clear until October, 1901, when hemorrhage returned. This, however, was not severe until within two months, when tenesmus has appeared and become severe. Pain shooting into legs troublesome.

July 18. Operation. Bladder holds six ounces. Suprapubic cystotomy shows bladder filled with large, irregular masses, largest on the left side. Masses removed with forceps and base cauterized. Bladder drained with tubes. Tenesmus relieved by operation. Pain in legs not relieved.

July 30. Pain in region of liver; no enlargement felt.

Patient returned home September 2, with suprapubic drainage through tubes connecting with the urinal, which kept him dry.

Died two months later.

CASE 3. J. P. K., aged 49; August 20, 1900; Dr. F. B. Harrington. Ten weeks ago first noticed blood in urine. Soon followed by some frequency and scalding. Now excruciating pain and almost constant tenesmus. Passes very little at a time. Frequency almost every ten minutes. Rectal palpation negative. Cystoscope not used.

August 21. Operation. Suprapubic cystotomy shows bladder filled with material resembling old blood clots. Pedunculated friable tumor on base of bladder at left extremity of trigone. Base seized by clamp; removed with cutting forceps down to the base. Base cauterized. Bladder wall closed without drainage. Wound above left open and packed with gauze. Catheter drainage.

Pathologist's report: Villous carcinoma.

August 27. Urine free from blood. No leakage from wound.

September 9. Urination normal. Wound nearly closed. Urine only microscopically bloody.

This patient had a long interval of comfort. Entered City Hospital in January, 1902, died in February.

CASE 4. E. N. E., aged 68; April 30, 1905; Dr. Hugh Cabot. Patient of Dr. W. H. Sayward, Jr. Eight years ago slight attack of hematuria following exertion. Since that time two slight attacks. Neither of these troublesome.

During the last two years has had some nocturnal frequency. During the last year patient's family think he has been losing weight.

Two days ago, after a hard day's work, sudden, profuse, painless hematuria. Examination shows spare, pale man, with some shortness of breath. Marked arteriosclerosis, intermittent, irregular pulse. Urine bloody, containing many small clots. Prostate is small, not remarkable. Bladder wall above prostate does not feel indurated. Hematuria subsided in seven days, leaving some bladder irritability, with a constant feeling as if bladder was not empty.

May 19. Cystoscope shows a large villous growth filling base of bladder. Outlines not determined on account of bleeding.

May 22. Operation. Suprapubic cystotomy shows base and a considerable portion of posterior wall of bladder covered with a soft villous growth. This was thoroughly curetted and cauterized and the growth found to have extended somewhat in front of the urethra. Considerable infiltration of bladder wall.

Bladder wound closed snugly around rubber drainage tube with inversion (Gibson) stitch. Soft catheter in urethra.

Pathologist's report: Villous carcinoma.

Five days after operation urine clear. Suprapubic tube removed.

Three weeks after operation left hospital. Wound healed. Passes urine freely. Urine practically clear.

January 20, 1906. Dr. Sayward reports that patient is as well as he has been at any time during past two or three years. Urination about every two hours in the day, three or four hours at night. Urine is slightly cloudy, with microscopic blood, but no obvious hemorrhage. Hgb. 50%. Is able to do light work, though cardiac condition is troublesome.

July, 1906. Patient seen at office, on account of slight attack of hematuria the day before, which has now subsided. Patient thinks he is as well as he has been for some time. Is able to attend to his business.

November, 1906. Began to have slight continuous hematuria, with some obstruction to urination. No pain.

Patient died in March, 1907, the bladder wound having opened about a month previously, on account of increasing obstruction to the urethra. Last weeks were painless, and he did not require an opiate.

CASE 5. J. H. L., aged 60; July 16, 1902; Dr. Hugh Cabot. Two years ago began to have intermittent painless hematuria. Six months ago hematuria became continuous. Cystoscopy at that time by Dr. G. S. Whiteside showed a friable villous growth, size of a horse-chestnut, in region of right ureter. Operation advised and refused.

Hematuria has continued until the present time.

Bladder shows a residual of about four ounces. Examination negative except for bladder. Rectal examination shows prostate moderately enlarged, and above the prostate an indefinite thickening.

July 17. Operation. Suprapubic cystotomy shows a soft villous growth surrounding the neck of the bladder and extending up on to the posterior wall. Growth thoroughly curetted and found to infiltrate bladder wall in many places. Hemorrhage checked with cautery. Bladder closed snugly around rubber drainage tube, with inversion (Gibson) stitch.

Pathologist's report: Villous carcinoma.

Drainage tube removed on fourth day and catheter drainage substituted. Wound dry.

Discharged from hospital August 23. Urine clear. Uses catheter at night, for four ounces residual.

Urine remained clear until January, 1903. Patient was entirely comfortable. During the following months, intermittent hematuria returned; cachexia became marked.

Died in August, 1903.

CASE 6. H. A. T., 63; September 26, 1899. Dr. J. C. Warren. March, 1899, began to have hemorrhage from the bladder—not so severe as to keep him from work, until June 18. Since July 18 has been in bed. Hemorrhage every three days, on the average. Lasts four hours. Patient passes good-sized clots of blood, sufficient to obstruct the urethra. Has sudden stoppage urination; has discomfort, but no pain except on walk-

ing and driving. Jolting of any kind painful. Frequency of micturition amounts to several times at night. This has existed since before hematuria began.

Examination negative except that prostate thought to be enlarged.

October 2. Examination under ether. Prostate not enlarged. Portion of tumor removed with lithotrite.

October 11. Operation. Suprapubic cystotomy shows a growth on the right side of the bladder extending to and possibly involving the prostate. Growth curetted and cauterized.

Pathologist's report: Cancer.

October 28. Bladder wound closed.

November 9. Urine macroscopically normal. Patient free from pain and passing urine without difficulty.

Died two months later.

CASE 7. J. L. Female. June 6, 1901. Dr. F. B. Harrington. Ten months ago some obstruction to and frequency of micturition. Eight months ago hematuria, which has been continuous. Rapid loss of weight and strength.

Vaginal examination shows a hard mass on anterior vaginal wall involving base and posterior wall of bladder.

June 6. Operation. Suprapubic cystotomy shows a large, irregular mass involving the base and posterior wall of the bladder. Projecting mass "bitten off." Base thoroughly curetted and cauterized. Bladder well closed without drainage.

Pathologist's report: Mesothelial cancer.

Patient much relieved by operation. Some sloughing of wound and leakage of urine.

June 28. Catheter out. Bladder wound healed.

August 4. Has gained much strength and is comfortable.

Died January 8, 1902, malignant disease of the bladder.

CASE 8. N. W., 40; January 31, 1904. Dr. A. T. Cabot. Three and a half years ago hematuria. Ever since that time with short intermissions, urine has contained blood, at times in large quantities, at other times blood clots in clear urine. No pain except from passage of clots. Marked anemia, otherwise well.

Rectal examination shows a hard nodule in the prostate. Cystoscope shows a tumor on the right side of the bladder wall close to the prostate.

February 13. Operation. Suprapubic cystotomy shows a papillary tumor on the right base and anterior wall of the bladder. This was removed with forceps and curette and thoroughly cauterized. Bladder wall snugly closed about rubber tube.

Pathologist's report: Epithelioma.

Urine practically free from blood three days after operation.

February 28. Suprapubic tube removed to-day. Patient had chill, some fever, tenderness over left kidney. Put upon catheter drainage.

March 2. No leakage from wound.

March 11. Cystoscope shows site of tumor smooth, free from clots or mucus. About the right ureter is a red area of cicatricial tissue.

August 1, 1904. Well until five weeks ago, when severe pain in lower back appeared. Two weeks ago hematuria of moderate amount with few clots.

Rectal examination shows thickening above the prostate, particularly upon the left. Moderate pyrexia occasionally reaching 101.

August 15, 1904. Operation. Suprapubic cystotomy somewhat difficult on account of previous scar. Bladder wall studded with many hard nodules, with considerable infiltration of bladder wall especially marked on the right side of the bladder. Noules on the base of the bladder curetted and cauterized. Bladder wall closed without drainage. Abdominal incision drained with gauze. Urine following operation free from blood.

Died two months later.

The above cases are few in number, too few, in fact, to serve as a basis for dogmatic or positive deductions, but sufficient to form the basis of an opinion and to point the direction in which further study may be carried out.

Case 1 is clearly a brilliant result. Life was undoubtedly prolonged for five years, and made not only bearable, but comfortable.

In Case 2 it seems fair to suppose that a year of reasonable comfort was added, and that the remaining time was made more bearable.

Case 3 was given at least a year of life, and possibly more.

Case 4 had more than a year of freedom from hematuria,

and health as good as it had been for several years. At no time during the remainder of his life did he have any considerable amount of pain, and the patient, at least, was satisfied that the operation had been of great benefit.

Case 5 was given six months of freedom from hematuria, a condition which could not have been expected without operation, as the hemorrhage had been persistent for the previous six months. From the return of hemorrhage to his death, he suffered no considerable pain.

Case 6, though not a favorable case, was given a moderate interval of comfort apparently well worth having.

Case 7, though also an unfavorable case, was made comfortable and able to gain strength and definitely improve, though for a short time.

Case 8 had three months of comfort from the first operation, and some relief from the second—sufficient probably to justify the attempt.

In estimating the benefit which patients get from palliative operation, the element of encouragement due to disappearance of hematuria and relief of symptoms, is an important and in many cases, the most important relief given. If this can be done at the cost of an operation which does not add to the patient's discomfort, and does not confine him to bed for a long time, it may in itself be worth striving for.

The following cases are examples of failure to obtain any considerable relief owing to faulty selection of cases and lack of accurate knowledge of existing conditions.

Case 9. E. B., 57; June 2, 1904. Dr. S. J. Mixter. Eight months ago frequency of micturition, three times at night. No pain or discomfort. One month ago pain in back and above groin, shooting to feet, kept him in bed for five days. Bladder obviously infected. Urine thick, cloudy, bloody. One week ago similar attack. Urination now very frequent, eight to ten times at night. No pain. Sudden stoppage of stream.

Two days ago acute retention. Bladder tumor, dull to percussion, extending nearly to umbilicus. Retention complete. Twenty ounces of urine drawn with disappearance of tumor. Rectal examination said to show great enlargement of left lobe, considerable of medium and right lobe of prostate. No tenderness.

Patient has shown some pyrexia, temperature frequently 100, once 102. Amount of urine varies from sixty to forty ounces.

Cystoscope thought to show malignant disease of prostate.

June 10. Operation. Suprapubic cystotomy shows bladder wall covered with villous nodules easily separated from the wall. Prostate moderately enlarged. Internal urethral orifice surrounded by growth which was easily scraped away. Growth not cauterized, not thoroughly curetted.

Pathologist's report: Cancer.

Following operation, bladder drained well by catheter. Temperature elevated, irregular. Amount of urine much diminished.

Died two weeks after operation, probably from pyelitis.

CASE 10. J. P., 35; June 12, 1905. Dr. Hugh Cabot. Two years ago, without obvious cause, began to have frequency of micturition amounting to every half hour during the day, every hour at night. Occasionally a few drops of blood at the end of micturition. At that time was treated by bladder irrigation with nearly complete relief of symptoms. Frequency entirely disappeared.

Four months ago, sudden, painless hematuria. Soon afterwards dull, aching pain in the outer side of both thighs, most marked upon the right and over coccyx.

Thinks he has lost twenty pounds in three months. No colic.

Examination shows a man who has apparently lost some weight.

Examination of abdomen negative except that lower border of liver is palpable.

Movements of hip joints, free, normal. Spine normal. Some tenderness over both sciatic nerves. Superficial and deep reflexes normal. No paralysis.

Rectal examination shows prostate normal, and an indefinite stiffening of base of bladder above prostate. Doubtful mass in region of bladder felt on bi-manual examination.

Cystoscopy shows large villous new growth.

June 16. Operation. Suprapubic cystotomy shows large villous growth which in places has infiltrated bladder wall. Short prolongation in front of urethra.

Surface of growth curetted down to the solid base which was

then freely cauterized and bleeding entirely checked. Bladder wound closed by inversion (Gibson) stitch of plain catgut around a medium rubber drainage tube. Soft rubber catheter in urethra.

Pathologist's report: Cancer.

Four days after operation, urine clear, drainage tube removed. No leakage.

July 15. Patient emptying bladder completely without difficulty. Wound healed. Urine slightly turbid. Pain in thighs not relieved. Cachexia beginning to be marked.

Died three weeks later.

CASE 11. C. S., 70; February, 1896. Dr. A. T. Cabot. First symptom two years ago. Suprapubic pain.

In June, 1895, had a sharp hemorrhage from the bladder. None since. Pain deep in the perineum. For the last eight weeks micturition very painful and frequent. Has lost twenty pounds in last six weeks. Micturition every twenty minutes to half an hour, accompanied by extreme pain. Urine very foul.

Rectal examination shows slightly enlarged prostate, but is otherwise negative.

February 25, 1896. Operation. Suprapubic cystotomy shows a large sessile growth occupying the right side of the bladder. Carefully curetted without severe hemorrhage.

Tube drainage.

Pathologist's report: Flat cell carcinoma.

Operation did not greatly relieve pain.

Died in hospital four months later.

CASE 12. E. B., 58; March 14, 1904. Dr. M. H. Richardson. One year ago severe pain lasting two weeks, during which time he passed gravel. Well until six weeks ago, when acute retention. Three weeks ago terrible pain on micturition, accompanied by free hemorrhage. Pain appears in rectum. Micturition every fifteen minutes.

Rectal examination shows great enlargement in the region of the prostate extending higher than the finger can reach. Some tenderness. Bladder holds but three ounces.

March 19. Operation. Suprapubic cystotomy shows bladder filled with blood clots and a sloughing mass on the right side of the bladder wall. This was partially removed. Not curetted

or cauterized. Bladder drained with three gauze wicks and two rubber tubes.

Pathologist's report: Cancer.

April 15. Fresh blood in the urine. Suprapubic opening not closed.

May 17. Discharged. Suprapubic wound closed. Marked hematuria. Has to use catheter in order to irrigate bladder and get rid of clots.

July 11, 1904. Died of cancer of the bladder.

In Case 9 the death was probably due to a pyelitis. This might have been suspected on account of the moderate pyrexia before operation, though it was probably impossible to be sure of its existence. In any case the extent of the growth was such as to make it improbable that considerable improvement could be obtained by operation.

Case 10 shows clearly the unwisdom of operating upon cases in which pain is due to extension of the disease to the pelvic glands and in which the hematuria does not require immediate relief. Although the operation went smoothly, the wound closed without difficulty, and the bladder symptoms were relieved, the chief complaint—pain—was not notably affected, and there is no reason for supposing that the patient was benefited by the operation.

Case 11 is one in which the benefit following operation was less than might reasonably have been expected. The pain was apparently due to difficulty in emptying the bladder. It was not, however, relieved by operation. The age of the patient, and the size of the growth, was such as to render it a palliative operation at best. The benefit received was probably slight.

Case 12 is one in which it seems possible that more relief might have been obtained by a somewhat better technique. The early return of hemorrhage might perhaps have been avoided by a thorough curetting and cauterization. Earlier closure of the bladder wound would probably have followed had the drainage consisted of tubes alone rather than wicks.

## PURELY PALLIATIVE OPERATIONS (CLASS 2)

It does not seem necessary to consume time in quoting cases to show the benefit of operation undertaken purely for the relief

of symptoms and consisting solely in a cystotomy. Several of the above cited cases obtained this benefit as well as others. No argument is required to show that when relief of pain can be obtained by a simple cystotomy, which may be done if desired, under cocaine anesthesia, the patient is entitled to it. To what extent operation is indicated for the relief of symptoms—hematuria—must remain a matter of opinion. While it is true that the hemorrhages are rarely fatal, and that in the majority of cases they stop without treatment, it should be borne in mind that hemorrhage from these tumors may in itself prove fatal or reduce the patient to such a condition that operation is deemed inadvisable. In all cases collected by Davis,[1] amounting to 41 in all, there appear 2 cases in which hemorrhage had been allowed to continue until the operation was thought to be inadvisable and in both cases death followed.

CASE 13. December 22, 1900. Man of 60 brought to Accident Room in extremely weak and anemic condition, with history of hematuria for six weeks. Has lost ground rapidly during the last three weeks.

Medical treatment of bladder failed to check hemorrhage and he died three weeks later.

Autopsy showed a papilloma of the bladder with a pedicle 1 cm. in diameter. There was no infiltration of the base or of bladder wall.

Except for the very marked anemia his condition was such that he would probably have withstood operation.

CASE 14. June 8, 1901. Man of 55. Has a congenital heart lesion. Painless hematuria began one and a half years ago.

For last three weeks hematuria constant. Bleeding continued while in the hospital, unaffected by medical treatment and he died one week later.

Autopsy showed a papilloma of the bladder, white, fibrous and shaggy, about 1½ x 1½ cm. Pedicle 7 mm. in diameter. Bladder full of blood clots. There was no infiltration of the bladder wall about the pedicle.

In spite of the condition of his heart he would probably have withstood operation, and the case was a favorable one for cure.

If such cases as these are likely to occur in 4% of the total

[1] *Annals of Surgery*, April, 1906.

number, the unwisdom of regarding hematuria as not in itself a dangerous symptom, becomes at once apparent.

Such an opinion, therefore, as that expressed by Escat must therefore be accepted with some caution remembering that in any individual case hemorrhage may be such as to prove fatal unless checked by operation.

## TECHNIQUE

Before concluding the paper, a few suggestions may be made in regard to the technique of this kind of operation, especially in regard to the method of closure of the bladder wound and management of drainage.

As it is of the first importance to obtain early and prompt healing, those methods should be selected which are likely to give this result.

Dr. Harrington prefers immediate suture of the bladder wall with drainage of the overlying tissues. (Cases 3 and 7.) A result quite as satisfactory may be obtained by the snug suture of the bladder wall around a medium-sized drainage tube by an inversion (Gibson) stitch. Wounds treated in this way have seemed to me to close quite as promptly as those treated by immediate suture, and perhaps expose the patient to somewhat less risk. Where this stitch is well executed and the bladder is drained by a catheter, when the suprapubic tube is removed, the amount of leakage is, as a rule, insignificant.

I have thought that prompt closure of the suprapubic wound was considerably aided by the use of the inlying catheter either from the start or from the time when the tube is removed. It has not appeared that the catheter irritated the bladder wall or conduced to bladder infection. The patients upon whom it has been used, have been comfortable, dry, and early out of bed. It seems a distinct addition to our technique.

The value of the cautery in the treatment of the base of cancerous tumors which have been removed by cutting or the curette has seemed considerable. It not only aids in checking the bleeding so that the bladder wound may be more completely closed, and the use of gauze packing dispensed with, but probably has a distinct effect in retarding the growth and giving a longer period of immunity. It is quite comparable to the excellent effects fre-

quently seen following cauterization of superficial malignant growths. The Paquelin cautery is somewhat difficult to use in this situation, and is likely to singe the edges of the bladder wound to their disadvantage. It an electro cautery can be obtained, it is distinctly the instrument of choice.

## CONCLUSIONS

It would have been an easy matter to add to the above cases others showing similar results, but this would have increased the bulk of the article without enhancing its value. The evidence submitted seems to me to show that real improvement in the condition of these patients may be obtained by operation. That bad results such as those mentioned by Escat, have followed operation, is not in itself sufficient to condemn it. The cases may have been unwisely selected, too radically dealt with, or, as seems most likely, represent the failures which are certain to occur in any attempt to stand off the progress of cancer. While they must be given due weight, they should not be allowed to befog the whole question.

The following conclusions are submitted:

1. That palliative operation is of value in the treatment of cancer of the bladder.

2. That in properly selected cases, operation will prolong comfortable existence very materially.

3. That suprapubic drainage of the bladder will relieve the symptoms and promote the comfort of patients for whom nothing more radical can be done.

4. That hemorrhage should not be allowed to continue unchecked unless efficient examination has conclusively shown that its cause cannot be removed by operation.

# URETHRAL CALCULI

By H. A. Fowler, M. D., of Washington, D. C.

CASES of urethral calculus, while not rare, are uncommon. They undoubtedly occur more frequently than is indicated by the number recorded in the literature, as only those cases which present unusual and interesting features are generally recorded.

The term "urethral calculus" has been used in a widely different sense by various writers. As generally employed, any calculus occurring in the urethra, without reference to its origin, is called a urethral calculus. Lieblein, however, contends that this use of the term is too broad. He would limit its use to include only those cases in which the stone develops within the urethra, or in which vesical calculi, becoming lodged in the urethra, undergo further growth. This view is held by Kaufman and Urstadt. In this narrow sense, the number of cases reported is relatively small. Lieblein, in 1896, could find but 54 cases in the literature, although over 200 cases of urethral calculi had been previously collected.

A calculus may form primarily within the urethra just as in the kidney or bladder. Such cases are rare. Most frequently they have their origin at a higher level in the urinary tract, pass into the urethra, and lodge behind a narrowing of the canal. Such narrowing may be either physiologic or pathologic. A stone of this kind may remain in the urethra for a varying length of time without undergoing further change. Or it may continue its growth, after reaching the urethra, by the deposition of new material, sometimes attaining large dimensions, and producing marked changes in the surrounding tissues. Hence, it seems best to divide these cases into two main groups: (1) the primary form in which the calculus develops within the urethra, or a urethral diverticulum; and (2) the secondary form, in which the calculus, formed at a higher level, bladder or kidney, passes into the urethra, and is arrested in its passage through the canal. The majority of cases belong to this latter group; and in by far the greater number of these, the stone causes such marked irritation that its

removal is promptly demanded. The presence of a stone in the bladder may not have given rise to any symptoms until it passed into the urethra. These are the cases which, according to Lieblein, should not be included in the cases of urethral calculi.

That a vesical calculus may become lodged in the urethra, remain there for a long time, and increase by the deposition of new layers of material, has been disputed by Grafe, who believes that all urethral calculi, which have remained in the urethral canal a sufficient length of time to permit of their further growth, must have formed primarily within the urethra. He says that a vesical calculus, which suddenly enters the urethra, causes such marked symptoms that the patient seeks immediate relief.

This view, however, cannot be accepted absolutely, as cases have been reported where small calculi of vesical origin have slipped into the urethra, following some violent exercise, and remained undisturbed for months or even years. In one of our cases, to be reported presently, a small stone, which was unquestionably of vesical origin, remained impacted in the urethra for five months. If the stone is small, and its surface smooth, as in our case, it is less likely to cause irritation, and may be tolerated by the patient for a long time.

All the factors concerned in the formation of a primary calculus in any part of the urinary tract, are not thoroughly understood. But we do know that certain conditions are necessary for their formation. These are: (1) the presence in the urine of an organic, or colloidal substance which acts as a matrix, and forms the framework of the stone: (2) the precipitation of the inorganic salts of the urine; and (3) some obstruction to the escape of the nucleus, when formed, thus permitting its further growth.

These conditions occur in the urethra chiefly in association with stricture and diverticula. Both of these play an important rôle in the formation of urethral calculi. The association of stricture with urethral calculus is very common. The obstruction caused by the stricture produces a stagnation of the urine which favors the deposition of the urinary salts. The urine becomes alkaline, which is also an important factor. The organic material, which is absolutely essential to stone formation, is furnished by the pus, blood, desquamated epithelium, and mucus, which occur in the urethra under these circumstances. A foreign body intro-

duced into the urethra, in rare instances, forms the nucleus of a stone. Trauma of the urethra, and incised wounds, as in external urethrotomy for stricture, or stone in the bladder, have been followed by the development of a calculus, often after an interval of years.

Calculi which form in diverticula of the urethra form a special group. They often attain enormous dimensions, and are among the largest recorded. In the thesis of Bourdillat, mention is made of a calculus weighing 1,450 grams, which was removed from a diverticulum between the prostate and rectum. This is the largest urethral calculus on record.

Diverticula of the urethra are either congenital or acquired. The former are very rare. Only 18 cases have been reported. They occur principally in children; the pouch is formed usually in the penile urethra. Stones associated with congenital diverticula are extremely rare, only two cases have been recorded. These were reported by Grube.

The acquired variety is much more common. They arise from a dilatation of the urethra due to obstruction, either from a stone, or a stricutre, or from a perforation of the urethra by the rupture of an abscess or cyst, or from injury. As distinguished from the congenital form, they occur usually in adults, and the favorite site is the membranous urethra, although they may occur at any point. The occurrence of stone in acquired diverticula is not at all common. Finsterer, in 1906, was able to collect only 24 cases. It is extremely difficult to say in some cases whether the stone develops in the diverticulum, or the pouch was formed by the gradual growth of the calculus. Interesting cases have been reported by Kaufman, Kapsammer, Lieblein, Suter, Finsterer, and others.

A number of cases of unusual dilatation of the urethra by a calculus, without the formation of a diverticulum, have been reported. They are interesting as showing how a patient will sometimes suffer a stone to remain in the urethra for years, gradually increasing in size, until it reaches enormous dimensions. They occur most commonly in the prostatic, membranous, or bulbous urethra. The symptoms produced by such a stone are generally pronounced. Dysuria is marked and most distressing. There is incontinence of urine when the stone lies in the membraneous

portion. If the wall of the urethra is injured by rough instrumentation, or damaged by inflammation, then follows infiltration, abscess formation with the formation of fistulæ. Sometimes the stone is passed spontaneously through a fistula formed in this way. In a few cases the stone has been removed successfully by operation. A brief abstract of three such cases, in which the calculus attained a very large size, follows:

In the case reported by Kubartow, the patient, 43 years old, had suffered with symptoms of stone for six years. For two years he had a fistula in the scrotum through which a small stone had escaped. One month before operation he had complete retention, followed by a swelling of the scrotum to five times its normal size. A stone was felt by a sound in the urethra, and a probe in the fistula. At operation a stone was removed weighing 300 grams, and measuring 9 by 9.5 cm. The patient recovered.

Rörig's patient was 45 years old. Since his nineteenth birthday he had suffered with dysuria and "paralysis of the sphincter." He was married at 26 years of age. There were no children for eleven years, then he had three. During the last four and a half years his symptoms were greatly aggravated, the pain in the urethra being very severe, especially on moving about. Examination revealed a swelling in the perineum extending from the scrotum backward. This could be felt externally and through the rectum. The calculus lay in the bulbous, membranous, and prostatic urethra. It was removed by operation. The rectum was injured during its removal. The patient died twenty days afterward.

Tesjakow reports a remarkable case of a young man 18 years of age, who complained of pain on urination. (Duration of symptoms not stated.) He had passed a stone through a scrotal fistula. There was great swelling of the scrotum. A stone could be felt with a probe in the fistula. A sound entered the urethra a distance of only two centimeters when it was obstructed by a stone. Crepitation could be made out. The urethra was opened through the scrotum and twenty stones were removed. The largest weighed 67 grams and measured 6 cm. long by 4.5 cm. broad. The total weight was 160 grams. The urethra was dilated from the membranous urethra to a point within two centimeters of the meatus.

I have recently operated on a patient with a huge calculus lying in the bulbous, membranous, and prostatic urethra. The history is as follows:

CASE 1. R. W., colored, aged 33 years, was admitted to the hospital complaining of incontinence of urine and pain in the perineum. Ten years ago, while working on an elevator in Chicago, he fell down the shaft a distance of 95 feet, sustaining a fracture of the pelvis. Following the accident, he was unable to void, and a catheter could not be passed to the bladder. A perineal section was done at once. He remained in the hospital three months. At the end of this time he was discharged perfectly well, the perineal wound had healed completely, and there was no urinary trouble present. For one year following his discharge from the hospital he felt perfectly well. He then had an abscess in the left testicle which was removed. He now began to suffer with frequent urination, accompanied with severe cutting pain in the perineum, and associated with the escape of pus and blood from the meatus and in the urine. For the next two years he was treated at one of the local hospitals with bladder irrigations and sounds. He was told that his trouble was evidently a stone, but nothing was ever found on repeated examinations. Operation was advised and refused. He then returned to his home in Virginia, where he has since been working for his father on the farm.

During the past six years he has not consulted a physician, and has taken no treatment, save large quantities of water and patent medicines. During this time he has worn a rubber urinal constantly. While moving about, if the urine was not escaping constantly, he suffered great pain in the urethra. To keep the urine flowing freely he drank "gallons of water every day." When sitting quietly, he could hold his water fifteen minutes. Finally, the pain and suffering becoming so great, he sought relief and entered Freedmen's Hospital in February, 1907. He has complete loss of sexual power which came on two years after the accident.

*Examination.*—Healthy young colored man. Presents the fascies of a constant sufferer. Chest and abdomen negative. There is double inguinal hernia, which the patient states has developed since his urinary troubles began. He is wearing a rubber urinal, there is constant dribbling of urine when standing. A

distinct depression can be made out in the pubic arch, in the midline, as though the bone had been driven downward and backward by a blow from above and in front.

In the perineum is a rounded swelling along the course of the urethra, extending from the scrotal margin behind backward nearly to the anus. This swelling is very prominent, rounded from side to side, the examining finger can be pushed up into a deep sulcus between the mass and the rami of the ischium. The mass is very hard, tender, and immovable, as though attached to the bone above.

*Rectal.*—Examination very painful. The introduction of the finger is followed by the escape of a quantity of urine and pus from the meatus. A rounded, very hard mass can be felt in the position of the prostate, regular in outline, and very tender. The bladder wall is easily reached above, and appears normal. The region of the vesicles is free.

*Urethra.*—A small silk catheter passed easily a distance of seven centimeters where an obstruction was met against which the catheter grated. A small silver catheter was then used and a distinct, characteristic click of a stone was obtained. Again the silk catheter was used and passed to the bladder. The urine obtained was light in color, turbid, very foul smelling, and contained pus and bacilli in abundance.

*Operation.*—The membranous urethra was exposed by using the same incision as for perineal prostatectomy. We seemed to be behind the most prominent part of the swelling which extended forward in the bulbous urethra. The incision into the urethra was made through the bulb, and at once the large, rounded, smooth posterior surface of the stone was brought into view. In order to reach and expose the outer or anterior end of the calculus, the urethra had to be freely opened as far as the scrotal margin. Lateral incisions through the dilated bulb were also necessary to free this portion of the stone and permit us to get around it and dislodge it from its bed. The incision was carried backward through the membranous urethra. It was impossible to tell, at this point, how far the calculus extended posteriorly, or to ascertain its shape and size. It was firmly fixed in position, wedged in between the rami of the ischium. Wishing to remove it entire, the outer end of the calculus was grasped by a pair of stone forceps

PLATE XXIV.—Presented by Dr. H. A. Fowler.

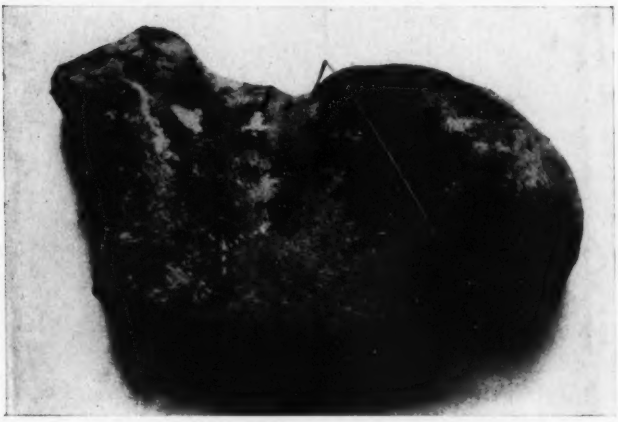

FIG. 1.—Lateral view of calculus. Natural size. Vesical end toward the left. The groove made by the external sphincter is seen on the upper (anterior) surface. The dark areas are due to staining with permanganate of potash after removal. The surface on removal was perfectly smooth and ashy gray in color. Weight, 106 grams.

FIG. 2.—Lower (posterior) view. Vesical end to the left is very rough, due to projecting crystals of phosphate of lime. Remainder of calculus smooth. The rough area at the upper right corner due to abrasion with forceps during removal.

by working one blade between the anterior surface of the calculus and the wall of the cavity. By firm, steady traction with both hands, wrenching gently from side to side, the stone was finally dislodged without injuring the soft parts, and removed entire. After the removal of the calculus, the interior of the bladder could be inspected through the dilated membranous and prostatic urethra which formed a circular opening approximately five centimeters in diameter. The incisions in the bulbous urethra were sutured, the wound lightly packed with iodoform gauze. No drainage tube was used. Healing was prompt.

The calculus lay directly in the dilated lumen of the urethra, and occupied the bulbous, membranous, and prostatic portions. As soon as the wound closed, the patient was able to hold his water for several hours while sitting. On standing there was at first slight incontinence, but control was regained before leaving the hospital. A No. 28 F. sound passed readily to the bladder. With the sound a considerable dilatation of the urethra occupied by the stone can be made out.

The shape and size of this calculus is shown in the accompanying photographs. When removed the surface was smooth, except the vesical end which is markedly rough and jagged. The color is a pale ashy gray. The dark colored areas shown on the photographs are due to staining with permanganate of potassium which was used on account of the extremely offensive odor of the calculus when it was removed. The dimensions are as follows: length, 7.4 cm.; width, vesical end, 3.5 cm., urethral end, 4.7 cm.; circumference, 19.8 cm.; vesical end, 14.2 cm., urethral end, 13.7 cm. When perfectly dry the stone weighed 106 grams. It is composed chiefly of calcium phosphate with a small amount of ammonia-magnesium phosphate. There is no uric acid, urates, nor oxalate of lime present.

The structure of the cut surface is well shown in the photograph. It will be seen in this view that the nucleus lies in the same horizontal plane as the groove made by the external sphincter muscle. That is to say, the nucleus of the calculus was formed in the membranous urethra, and lies in the center of the stone. Growth occurred in both directions, toward the bladder and toward the anterior urethra. It is stated that in urethral calculi the nucleus will generally be found in the outer or distal end, and that

growth takes place chiefly toward the bladder. It is apparent that such is not the case in our specimen.

As to the origin of the calculus, it is evident that it is of primary urethral formation. We assume this from the history of the case, and the structure and composition of the stone. There was no history of urinary troubles previous to the accident ten years ago. At that time there was an injury to the urethra, making it necessary to open the bladder through the perineum. Following the injury there was no urinary disturbance for a period of one year. Then were noticed those symptoms which continued for nine years and finally compelled the patient to seek relief. The abscess of the testicle, which was removed, was evidently associated with the urethral condition, and was due to a descending infection. At no time did his symptoms become suddenly worse, or change in character, as when a stone enters the urethra from the bladder. No stricture of the urethra was found at operation. It is evident, therefore, that the formation of the calculus was intra-urethral and was associated with or depended upon the injury to the urethra. The nature and extent of this injury we do not know, but it must have been severe as the patient could not void and it was impossible to reach the bladder with a catheter. We have, then, in this case an example of trauma of the urethra followed by the development of a calculus.

The size of the stone is noteworthy. A relatively small number of similar cases have been reported in which the calculus was as large or larger. As already pointed out, the largest specimens of urethral calculi are found in diverticula. In the literature of later years only three cases similar to ours are found where the stone was larger. In two of these they were removed by operation. One recovered and one died twenty days afterward from injury to the rectum during the operation. In the third case the stone passed spontaneously through a fistula.

Our specimen belongs to the large group of phosphate of lime calculi. Triple phosphates are present only as an impurity. Calculi composed entirely or chiefly of triple phosphates are exceedingly rare. Suter reports one such case.

A second case of urethral calculus upon which I have operated during the past year is of considerable interest on account of the severity of the symptoms produced by such a small stone. In this

PLATE XXV.—Presented by Dr. H. A. Fowler.

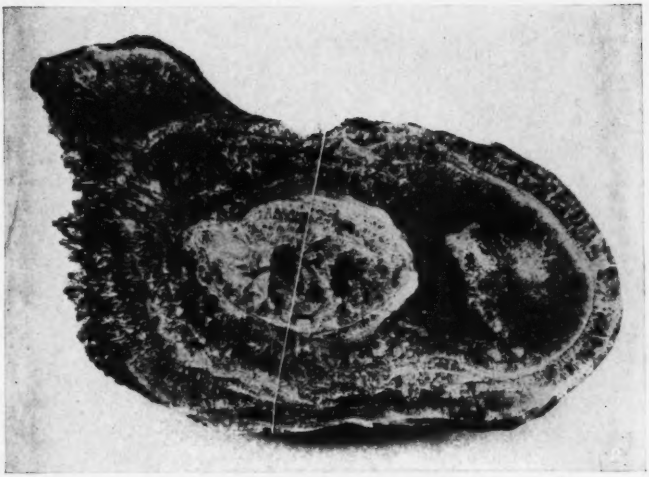

FIG. 3.—Cut surface of same, slightly enlarged. The nucleus lies in the centre of the calculus in the same plane as the groove made by the external sphincter. The arrangement into indistinct concentric layers, especially in outer portion, can be made out.

case the stone was formed in the bladder, and lodged in the urethra behind a tight stricture, where it remained for five months. Hence this case belongs to the group of secondary urethral calculi. The history is briefly as follows:

CASE 2. G. B., aged 62 years, was seen in consultation June 19, 1906. He complained of frequent and painful urination. He had gonorrhœa at 18 years of age which lasted five or six months. The discharge has recurred three times. He has had internal urethrotomy for stricture performed which was followed by profuse hemorrhage. He has taken chloroform eleven times to have the stricture dilated. Two years ago, following a debauch of several days, he had marked hematuria lasting twenty-four hours. Once since then he has passed a considerable number of blood clots. There has never been any pain in the region of either kidney or along the ureters. The only urinary trouble aside from the hematuria has been the difficulty of voiding due to the stricture.

*Present Illness.*—In February, 1906, following a sudden violent exertion, he noticed something slip into the urethra. He at once began to pass his urine at frequent intervals and at the end of the act he had sharp, cutting pain located at the root of the penis, and radiating along the left side of the urethra to the glans. Just previous to this he passed a fairly free stream at normal intervals and without pain. His symptoms became more marked, the suffering with urination was intense, and the pain in the urethra on walking about became so great that finally he was compelled to take to his bed.

When first seen in June, he was emaciated and extremely nervous. In urinating he assumed a peculiar posture. He would squat down with the thighs strongly flexed on the abdomen and the knees bent. In this position he would wait a considerable time for the stream to start. As the urine came he would raise himself by straightening the legs, keeping the body bent forward, and swaying backward and forward by raising himself on his tiptoes. The urine was followed by severe cutting pain along the left side of the penis extending from the root to the glans.

The urine was turbid, very foul smelling, alkaline, sp. gr. 1,010, albumin present. Mic. examination: no casts, few pus cells, red blood cells, abundant crystals of triple phosphate and bacteria. The patient was so nervous that no local examination not even of

the rectum could be made. Suspecting a urethral calculus associated with a stricture, the patient was sent to the hospital for examination under an anæsthetic and operation. Under an anæsthetic we found a stricture 5 cm. from the meatus which was readily dilated. In the membranous urethra there was a second very tight stricture which permitted only a filiform to pass. This was dilated by a Le Fort follower until a No. 19 F. sound could be passed easily to the bladder. No stone could be felt in the bladder, and nothing was felt at first in the urethra. Withdrawing the sound and searching the urethra carefully a stone was detected lying behind the stricture.

The urethra was opened in the perineum, and a small oval calculus was found lying in a pouch behind a tight stricture of the membranous urethra. Some difficulty was experienced in grasping the stone on account of the tightness of the stricture. It was finally pushed back into the bladder and removed by a pair of stone forceps. The patient made a good recovery. At the present time, eleven months after the operation, he is perfectly well. He urinates at normal intervals without pain, and the urethra admits a Kollman dilator which can be opened with ease to No. 36.

The calculus is egg-shaped, light cream in color, with a smooth, polished surface. It measures 1.3 cm. by 0.9 cm. It is composed of pure phosphate of lime.

This case illustrates the commonest variety of urethral calculus. There can be no doubt from the history that the stone formed in the bladder and slipped into the urethra where it caused such intense suffering. The patient had kept his bed for several weeks previous to the operation, as the pain on moving about was unbearable. Had the urethra been of normal caliber the stone would undoubtedly have passed readily.

# SOME REMARKS ON PROSTATIC CARCINOMA

By FAXTON E. GARDNER, M. D., of New York City

WHILE, in the past decade, simple senile hypertrophy of the prostate has been exhaustively studied as to its surgical aspects, and while the achievements of surgery along that line have been really remarkable, comparatively little has been said and done, until recently, about the treatment of prostatic carcinoma, and yet, the latter question is by no means uninteresting. Two causes are to blame for this relative paucity in the literature: First, a formerly alleged infrequency of the condition; and secondly, a sweeping condemnation of all operative procedures, passed some twenty years ago by one of undisputed authority, *i. e.*, Guyon. This *noli me tangere* rule was amply justified by the main clinical features of the disease and the dismal failure of all surgical attempts; but, as the question was settled on a total abstention basis, operators lost practically all interest in it. Recent and original studies, without altering the chief characteristics of this classical conception of the disease, have broadened and modified the latter in some respects, and these theoretical changes have been conducive of some considerable therapeutical activity. Whether the latter is right or wrong remains to be seen, but, at any rate, we have here presented a new and fascinating side of the problem, which deserves serious consideration now that the real frequency of epithelial lesions in the prostate is better understood.

Nowhere, indeed, have the older ideas been modified as thoroughly as in this question of the frequency of prostatic carcinoma; few subjects afford a more striking demonstration of that law of medical observation which Charcot was wont to quote, namely, that we see only what we have learned to see.

Needless it is to recall here the very small proportion of five cancers of the prostate in 1904 cancers in males given by Tanchou about fifty years ago, unless we contrast it with the figures given by the most recent writers on the subject, *i. e.*, 14% of all hypertrophied prostates (Albarran and Hallé); 9.5% (Oraison and Pousson), and one in every 7 cases (Young). Hyper-

trophy being a very common disease, we can realize the tremendous difference between those statistics, one making prostatic carcinoma one of the very rarest new-growths, the other, one of the most frequent.

Such an increase in frequency is due partly to better clinical observation, but chiefly to microscopical research, which has extended the domain of prostatic carcinoma in two directions: first, it has shown malignancy to exist in lesions clinically and microscopically indistinguishable from common benign senile hypertrophy; and, secondly, it has evidenced the primordial rôle of the prostate in a large number of vesical tumors formerly considered as originating in the epithelium of the bladder itself.

We know that a close relationship exists between the lesions of senile hypertrophy and those of cancer of the prostate. The fundamental and constant one in all cases of senile enlargement, of whatever anatomical form, is a typical adenomatous proliferation of the glandular element. Let this typical proliferation become atypical and there will be produced a graded series of epithelial malignant lesions extending from true hypertrophy to the most diffuse forms of "prostato-pelvic carcinosis," with adenoid epithelioma, epithelial infiltration of the stroma, and alveolar cancer as intermediate stages. Here, clinical observation is unable to follow the microscope, hence the objection of Forgue, when he says: "Undoubtedly there are cases in which we see cancer develop after benign senile hypertrophy, but it seems to us that this clinical eventuality is less frequent than anatomical pathology would lead us to fear. Such an occurrence is not without a parallel, ovarian cysts affording us a striking demonstration of the fact." We do not, however, think the latter example especially fitting, as ovarian cysts form a peculiar class of tumors, developing in an organ differing widely in histological structure from all secreting glands of the body; while, on the contrary, all other glandular formations, whether in the thyroid, the parotid, the breast, or the stomach, offer examples of processes absolutely similar to those which evolve a prostatic carcinoma arising from a benign hypertrophy. From the standpoints of general pathology and histology, the theory founded by Albarran and Hallé is unimpeachable. The malignancy of the lesions found by them cannot be questioned.

But Forgue is right when he asserts that the *clinical* eventuality is less frequent than the microscope seems to indicate. Professor Guyon, whose experience with prostatic hypertrophy extends over a period of over forty years, says that he has certainly seen such a clinical transformation, though not frequently; when Professor Albarran first communicated to him his microscopical findings he considered them simply as an exceptional series of cases. This latter view would be untenable now; the above mentioned high percentages have been found time and time again by trustworthy observers, and simply to admit coincidences would be straining a point too far. But this discrepancy between clinical and microscopical findings is due to the latency of the disease: epithelial degeneration is frequent, but also very slow and insidious; if left undisturbed, it takes months and years before the transformation is brought about to any considerable extent; so that these patients have time enough to die from the effects of prostatic obstruction before the pathological condition develops into a *clinically* demonstrable cancer.

This view finds confirmatory evidence in the following facts: Albarran and Hallé's patients, with perhaps one exception, died of prostatism, and *not* of cancer; and an overwhelming majority of the early cases of cancer operated upon had been diagnosed and operated upon as simple hypertrophy. Some four years ago, the following case came under my observation, a good illustration of the slow progress of the change and of the insidiousness of its clinical manifestations. The patient presented himself in the early part of 1903, complaining only of very mild urinary symptoms and of pains in the legs. The residual urine,—perfectly clear,—amounted to but one ounce; his general condition was good, and there had been absolutely no loss of flesh. Rectal examination, however, revealed the existence of a prostatic carcinoma, already involving extensively the lymphatic vessels and glands of the pelvis, the prostate itself being easily mapped out. This patient had applied in 1897 to the Necker Clinic in Paris for the relief of congestive symptoms, due to incipient hypertrophy, and at that time the size of the gland was very carefully noted. Six years later, with hardly any clinical history at all, and, at least, without the slightest aggravation in the urinary symptoms, the prostatic hypertrophy had evoluted into a carcinoma of exactly the same size.

The question now arises: Are all prostatic cancers transformed hypertrophies? It is very likely that all cancers have at some time or other during their evolution an adenomatous stage, but this has not the same significance in all cases. In fact, we must establish two classes: in the first, a benign hypertrophy existing during a long period, ten to fifteen years or more, when suddenly the aspect changes and cancer appears; in the second, the prostatic enlargement is accompanied from the beginning by symptoms which show the malignant nature of the affection; in this class the adenomatous stage is only a transitory period in the evolution of a primary carcinoma.

The exact relationship between vesical and prostatic tumors has long been a mooted question. It has been customary to teach that in most cases tumors of the bladder and of the prostate develop independently of one another, and more particularly, that the bladder is but little, if at all, involved in prostatic carcinoma, and only then at a late period of the disease. Pasteau, Motz, and Majewski, by anatomical research; Young, by the use of cystoscopy, have established the real frequency of vesical propagations in malignant epithelial disease of the prostate. Motz and Montfort go one step further and consider all tumors of the bladder not directly derived from the vesical epithelium as originating in the prostate; in fact, they are *prostato-vesical* new-growths. Their arguments are certainly weighty; we have a right to see more than a coincidence in the overwhelming majority of such tumors in males and in their most constant location, near the trigonum.

Recently I have observed a good example of this type of carcinoma. A man 60 years of age was operated upon, in June, 1905, for a tumor of the right postero-lateral region of the bladder. During the operation, exploration with the finger showed the prostate to be apparently normal in consistency. Recovery was uneventful. The excised specimen was an epithelioma with many karyocinetic figures near the implantation on the bladder wall. Four weeks after the operation, the patient began to complain of pains in the lumbar region similar to those which were present before removal of the tumor and which had been ascribed to cystitis. When I saw him again, early in August, rectal examination detected a very extensive prostato-pelvic carcinoma, the progress of which was exceedingly rapid, as the patient died one month later

markedly cachectic, and after several days of uræmic coma. In this case, as in many others, the latency of the primary prostatic lesion contrasting with the pronounced symptoms of the secondary vesical propagation led to an erroneous diagnosis; and when one considers the clinical data of this class of cases, similar mistakes would seem almost unavoidable.

Probably we find in these prostato-vesical new-growths, with an almost insignificant initial prostatic lesion and considerable secondary involvement of the bladder, the explanation of some of the rapid recurrences—so rapid that we almost ought to speak of continuation of the evolution of the tumor rather than of recurrence—observed after an apparently satisfactory and radical operation of certain so-called vesical tumors.

The evolution of prostatic carcinoma tends toward diffusion and invasion of the lymphatic system. The diffusive tendency has been regarded as constant by Professor Guyon, who justifies in the following terms the new name he has given the disease: "If I have preferred the denomination of 'prostato-pelvic carcinoma' it is because I have deemed it wise to warn clinicians, from the beginning, that usually they do not have to deal in these cases with a localized lesion developing with more or less intensity, in the immediate vicinity of its initial point. The chief characteristic of this variety of cancer is its rapid and multiple extension." This view is to-day very generally held in France, but in Germany the contrary prevails. Socin, Burckhardt, and Fürstenheim contend that the involvement of the lymphatic glands is not as much marked in prostatic carcinoma as in cancers of other organs.

Dr. Young goes farther in the same direction, and declares that he found enlarged glands in only a small percentage of cases, even among the advanced ones; and then they have no diagnostic or prognostic value, because they may be found also in cases of ordinary chronic inflammation. He also says that prostatic carcinoma produces bone metastases oftener than it causes lymphatic involvement. Certainly, the frequency of bony metastases is quite singular and worthy of notice. Lurz's studies make it even appear very likely that a great many bones which do not show any changes macroscopically are, indeed, the seat of microscopic embolism. But we cannot admit these bony involvements to be more frequent than that of the lymphatics. The latter, in

fact, is constant in the moderately advanced forms of the disease. Pasteau found it 70 times out of 71 cases, and more recently Motz and Majewski 25 times out of 26 cases. The abundance of the lymphatic channels of the prostate, so numerous that they have won for the gland the name of lymphatic sponge, and the direct connections of these lymphatics with all groups of glands of the pelvis, explain why this propagation should be almost constant.

How, therefore, can we account for the radical difference between Dr. Young's statistics and those of all the authors of the Necker school? A fact which Pasteau recently brought to my attention, may have some bearing upon this point: when looking for lymph-gland propagations in diseases of the prostate or of the bladder, a special technic is necessary for the removal of the urinary and abdominal organs from the body; if the whole mass is not removed absolutely flush with the surface of the bones of the pelvis and the spine, a number of diseased glands are almost invariably overlooked. Pasteau explains that, when he began to investigate the subject, he did not always find the glands, but later, when he had perfected his technic, he invariably found some.

But the true reason of this diversity of opinion is, I think, that Dr. Young's statistics contain a large number, if not a majority, of very young carcinomata. These are histological, and not clinical, lesions, and can be diagnosed as cancerous only with the aid of a microscope. Such early lesions naturally do not show any propagation, but the same would be the case with carcinomas of any other organ taken at the same stage. If we compare very young prostatic, carcinomata, and clinical—that is, older—cancers of other organs, we may reach the conclusion of the German school; but if we compare only cancers of the same age, we will constantly find more involvement of the lymphatic system in prostatic carcinoma than in others.

We must even add that in those early—histological—stages, the former shows still a greater diffusive tendency than the latter. When Fournier states that Albarran and Hallé have not found in their 14 cases a single involvement of the lymphatic glands, he is correct in a strictly literal sense, as they found hypertrophied glands only once, and these glands were only inflammatory; but he is in fact mistaken, as twice—and they dwell on the fact—they

discovered an early invasion of the lymphatic vessels, and this, from a therapeutic standpoint, has exactly the same import as adenitis itself.

Pasteau reports a case in which a well circumscribed carcinoma had produced on the left side, a voluminous mass of conglomerated glands, extending from the base of the prostate up to the diaphragm, said mass pressing on the ureter. On the right side, there were several hypertrophied glands along the iliac vessels.

We can also quote with this the patient on whom Baudet performed the first French prostatectomy. The patient had been admitted to the hospital (by Dr. Kendirdjy, who supplied me with these details), for a marked left inguinal adenitis of an uncertain nature, considered as probably tuberculous. Excision of said mass was simple. While still in bed after operation, he developed some congestive urinary symptoms such as are generally associated with incipient prostatic hypertrophy. Prostatectomy was then performed, and four months later, the patient died from a malignant recurrence. Does it not seem likely that there was one of those so easily overlooked carcinomas, which take on, for a short period, the mask of hypertrophy? And does not the evolution throw a singularly illuminating light on the uncertain nature of the inguinal adenitis?

We may still quote here one of Dr. Young's own early cases operated upon. Death came shortly after the operation, and the autopsy demonstrated the existence of extensive peritoneal metastases, the result of lymphatic propagation also.

Facts of this type will become more numerous when the early stages of the affection will be better known, and we must not forget that the study of those stages has only just begun. They show us the diffusive tendency which the normal anatomy of the prostate and the general pathology of tumors render very likely, which clinical observation shows beyond doubt in the great majority of cases,—really we ought to say the entire number of the *clinically diagnosed* cases,—exists also in the early forms of the disease, and this is the theory as always upheld by Professor Guyon.

Among the microscopical lesions of the early stages of prostatic carcinoma, one is especially interesting, and does not seem to have received the attention it deserves; I refer to the condition of the endo- and periprostatic nerves. Albarran and Hallé found

in one case the lymphatic sheaths of these nerves invaded by an epithelial proliferation; they were stuffed with polygonal cells forming a circular layer around the nerve; in several points even, the cells penetrated and separated the nerve fibers. Their accompanying illustration is very explicit on the nature of this lesion, which is certainly common enough, since Pousson found it in 3 out of 6 cases. We believe there is more than a coincidence in that proportion of 50%, and we think that cancerous neuritis is a far better explanation of the early pains observed in all cases, when pressure on the nerve trunks of the pelvis is out of question, than all other causes referred to heretofore, such as tension of the capsule, or engorgement of the glandular acini. Further investigation will probably establish this causal relation.

Can surgery give us a radical cure for prostatic carcinoma? This is the all-important question from a practical standpoint. The dominating conception of "prostato-pelvic carcinosis" had as a logical consequence therapeutical abstention, insofar as curative treatment was concerned. And post-operative results added to theoretical arguments, the weight of lamentably constant facts. Operative attempts against malignant disease of the prostate are almost as old as the knowledge of the condition itself. Since the experiments of Küchler on the cadaver (1866), since the first operation by Billroth in 1867, many surgeons have at various times, and under various circumstances, extirpated or tried to extirpate in different ways, different kinds of prostatic tumors, and, barring a success in Socin's hands (1892), with a case of *fibro*-sarcoma, *all* had decidedly bad results.

When the early forms of prostatic carcinoma began to be known, prostatectomy was rapidly rising, and it was natural enough that better hopes should be entertained. Adenot, Harrison, Gayet, Pousson, Albarran, Desnos, Haubold, and Squier operated upon several cases by subcapsular perineal prostatectomy by "morcellement." Lately Pousson, in cases of cancer, has switched systematically from this "morcellement" operation to the suprapubic enucleation which Harrison had already used inadvertently in an incorrectly diagnosed case.* The latter is no more than the first a fit procedure against carcinoma. Any op-

* Same happened to Cauterman. He notes that this case was the only one not benefited at all by operation; his seven real hypertrophies were wonderfully improved.

eration that separates by blunt dissection along more or less artificial planes of cleavage, tears or cuts through a carcinomatous mass, is not considered as being good surgery, and should be rejected *ipso facto.*

Dr. Young, seeing that those methods fell decidedly short of the necessary requisites, devised and applied in several cases, an improved technic; this he first described two years ago. He removes the prostate, not by "morcellement," but *en masse* with both vesicles, and a long portion of the vasa deferentia, and the connective tissue which surrounds the latter, which is simply stuffed with lymphatic vessels; also a cuff of the bladder comprising all the prostatic portion, and an extra ring, extending to within 1 cm. of the ureteral orifices.

Thus he goes considerably farther than any surgeon had done before, and avoids the capital defect of all piecemeal operations, namely, the cutting through a cancerous mass with the consequent danger of wound inoculation. Young's method seems to be the only one having some chances of a durable success, if any operation can give anything in prostatic carcinoma, which, at the present, we think is very open to doubt.

The only conditions that ever gave, in cancer surgery, permanent results in a few happy and selected cases, are the following: A well limited lesion, in a well exposed organ, with but few and easily accessible lymphatic connections. All these factors concur in making feasible a large excision of the lesion, and its possible propagations, with a safe margin of healthy surrounding tissue, without too many manipulations, which might cause a local inoculation or an embolic contamination.

Now, we know the prostate realizes exactly the reverse of these conditions. It is not easily accessible through the perineum, which is the only possible way in case of cancer. Its lymphatic network is very rich, and its lymphatic connections are, without doubt, beyond the reach of surgery.

The operative field is necessarily limited, more so perhaps than in the case of any other organ. The venous vesico-prostatic plexuses are always ready to give an abundant and often troublesome hemorrhage, sometimes difficult to control, all the more because periprostatic tissues are more vascularized in cases of carcinoma than in simple hypertrophy. When opened, which

seems most difficult to avoid in a radical operation, these plexuses will most certainly engulf septic products, if any are present, and cancerous grafts. Lurz's studies have demonstrated the great tendency of prostatic carcinoma to send microscopical emboli into the blood.

It would certainly be difficult, considering the region, to devise a more radical operation than Young's, but even with his technic, we remain far on this side of the lymphatic glands. Must we recall here the capital importance of the removal of the latter, as illustrated in all modern surgery of malignant epithelial lesions? Who would remove to-day a carcinoma of the breast, however limited, without at the same time cleaning the axilla of its glands? By the removal of the vasa, or at least a portion of them, in Dr. Young's technic, we undoubtedly remove one of the most important efferent lymphatic vessels of the prostate, but this is not enough; and recurrence in the very point of section of the vasa after eleven months, in one of Young's cases, shows that precisely here, in an incomplete lymphatic excision, lies the weak point of the method.

Any attempt to go farther and extirpate the glands themselves, would be attended by great risk, and the result would in all probability parallel those obtained by some European surgeons a few years ago, when they thought they could extend almost indefinitely—up to the limits of feasibility—the operations for uterine cancer, and therefore were led to perform complete pelvic lymphatic enucleation. This was attended by such an immediate mortality, as to deter even the boldest, inasmuch as also ultimate results were thoroughly bad. As Professor Albarran has remarked suggestively, we must not consider operative exercises in the living, as the same thing as surgery.

But then, if the operative conditions of the surgery of prostatic carcinoma are decidedly unfavorable on account of anatomical relations, the limitation of the lesions may perhaps make up for this to a certain extent? Such was the hope of surgeons when the forms of transition between hypertrophy and cancer were first described; they thought they had found in them nicely delimited carcinomas, and that belief was the basis for all interferences aiming to be radical. But, unfortunately, this hope is not well sustained by facts. I have already insisted above on the fre-

quency of extensive propagations, even in the early and seemingly perfectly limited lesions.

And we must not believe that when we find in a prostate a limited induration, it corresponds to a limited involvement of equal size. Induration in prostatic carcinoma is only a secondary, that is a late, manifestation; Motz and Majewski have shown this conclusively. It is caused by a secondary sclerous transformation of the connective stroma irritated by the epithelial proliferation. In adeno-carcinoma and in alveolar cancer, such a change ordinarily takes place; but in adeno-epithelioma—or adenoid epithelioma, to use Albarran and Hallé's appellation—by far the most frequent of all histological forms of epithelial malignant disease of the prostate, it does not occur in a majority of cases; and if it does, it is only very slowly and at a very late period.

Therefore, induration is absent in quite a number of cases, and we must not wonder when we hear Albarran and Hallé declare explicitly, and dwell on the fact, that the naked-eye appearance and consistency of those prostates are not different from those observed in simple senile hypertrophy. Moreover, when induration does exist, it exists only in the oldest part of the epithelial mass, that is, in the center; the malignant degeneration extends far beyond its limits, so far, indeed, that there is not a clinical sign that may be relied upon to say where it stops. And, lastly, though the sclerous transformation may exist, it does not always necessarily give clinical induration; if the node is central and imbedded in thick normal tissue, nothing is felt.

Therefore, the possibility, of an early diagnosis, becomes our last hope. An early diagnosis is always necessary in all cases of cancer, when an operative interference is considered, but how much more so, when the diffusive tendency of the disease, and the anatomical connections of the organ are such as have just been described? Now, this *truly early* diagnosis is in fact rarely possible, on account of some peculiarities of the clinical evolution of the disease.

When carcinoma develops on a previous hypertrophy, the change takes place so slowly, and the symptoms are modified so progressively, that nothing draws our attention to malignancy, before the latter has gained considerable headway. We have reported above a case which typifies this point.

The prostate itself causes *no symptoms* in prostatic carcinoma; the subjective symptoms are given *by the bladder* and the pelvic organs, so that a symptom which causes the patient to come to the surgeon's attention, appears only when the disease has gone beyond the gland itself, and irritates another organ.

This is particularly true of primary cancers; in those developing on a previous hypertrophy, the symptoms due to the latter affection may often have led the patient to seek relief, and some signs may perhaps enable the surgeon to suspect early degeneration. But we must not exaggerate the value of those symptoms; they are far from constant, and sometimes difficult to interpret correctly.

*Hematuria*, for instance, would be an excellent danger signal, because it frightens the patient and brings him quickly to the surgeon. Spontaneous hematuria is never seen in simple hypertrophy, but it is far from constant even in advanced cases of carcinoma. In 9 cases of prostato-pelvic cancer, I have not seen it, and only twice have I seen slight bleedings after exploration. If it is so in advanced cases, how much more must it be in the early ones? Out of 6 early cases operated on by Pousson, the absence of any bleeding whatever is explicitly noted in 5. In one, it was present, but the patient had previously been submitted to considerable instrumental exploration. The other similar cases reported in Fournier's thesis, tend also to show that even in early cases, really spontaneous hematuria is a very uncommon occurrence.

*An early and considerable amount of residual urine* in the bladder is also very suspicious, but this is not very frequent either. In my 9 cases, six times the residual amount of urine varied from half an ounce to an ounce and a half; seven times it was perfectly clear. Once there was a slight infected residual; once the amount was greater and also infected; in the two last mentioned cases, the patients had been submitted to repeated catheterizations.

Finally, *pain*, which is usually frequent and early in cancer, is so vague and indefinite in character that it is very difficult to trace it to its true origin.

I have seen recently, a case of sarcoma of the prostate where the patient complained of deep perineal pains, and of intermittent

difficulty of micturition during ten months before the real diagnosis was even suspected, and though he was very regular in attendance, and rectal, urethral, and vesical examinations with the searcher and by cystoscopy, were each done several times without showing any lesion that might have accounted for the pains the patient came to complain of regularly, with an insistency that made it impossible to ascribe them only to his decidedly neurotic temperament. Suddenly, he began to lose flesh, and rectal examination showed a much enlarged prostate, hard and smooth on all its surface, while not long before, the consistency and size were still normal. At the same time, vesical examination showed a large intra-vesical projection and the rate of growth became exceedingly rapid, the tumor passing in a few weeks from the size of a hen's egg to that of an orange. This shows how difficult it may be to give pain its proper significance.

It is our firm belief that a really early diagnosis of prostatic carcinoma is but rarely possible. It may be sometimes made in cases developing on a previous hypertrophy, but in cases of primary cancer, the patients will never come to the surgeon before it is much too late to consider, even for a moment, any operative interference. Dr. J. Bentley Squier has pointedly described this in an able paper. Personally, I have seen that those cases apply for relief, *first*, when the sciatic nerve begins to feel the effects of pressure. The complaint that brings them to our notice, is, *pain in the legs*, much more than *troubles of micturition*.

The usual clinical picture is the following, which was particularly well illustrated in the last case I saw: An elderly man, generally well nourished, complains of intermittent pains in the leg and a diagnosis of sciatica has probably often been made. Careful interrogation brings out the fact that there is a little frequency, the canal is normal, and the bladder contains about an ounce of clear residual urine. *Per rectum*, however, there is a diffuse prostato-pelvic mass. The contrast between the extensive objective lesions, and the extreme benignity of the subjective symptoms is striking. The first time I found a case of cancer, that disparity led me to doubt the correctness of my diagnosis; but Professor Guyon, whose intern I then was, informed me that such was the common evolution. Except at the very final period, primary cancer of the prostate runs a very mild clinical course.

And we believe it is the same with most cancers developing on a previous hypertrophy, otherwise more carcinomas would be clinical, while an immense majority of the cases hitherto published are purely histological findings, either after death, or after an operation for what was clinically a simple hypertrophy. I do not think enough stress has been laid on the foregoing facts when the advisability of an operative procedure was to be discussed, and when results had to be estimated at their real value. There is nothing to boast of in a prolongation of life of a year or eighteen months after an operation, for it is a fair assumption that the disease left to its natural evolution would have lasted as long.

In the estimate of the possible duration of prostatic carcinoma, too low figures have been given. By Stein, a year, certainly far below the reality. The first case which Professor Guyon saw had a diffuse cancer in 1868, and he was still living in 1872. Another had also an extensive carcinoma in 1901, and led a comfortable existence up to 1905. Guyon has seen many such cases. If, now, we think of the long latent period that elapses before the disease is diagnosed, we realize how long must be its natural course. And this is not surprising. The prostate has no vital function, the impairment of which might bring a deep physiological disturbance; it is not exposed to extraneous irritating influences, as are, for instance, the different parts of the digestive tract, or any of the hollow organs. Therefore, we may understand why very extensive anatomical lesions can exist with a minimum of clinical symptoms.

And now, how much improvement have modern methods brought in the results of excision of prostatic carcinoma? They certainly have reduced very much the terrible mortality of the first statistics. But, barring one or two exceptions, the post-operative history is one of rapid recurrence, and death after a few months. I have made a canvass of all operations performed in France, and have written to all operators. From all, except Pousson, came the same answer; there may be after the operation a short improvement in the symptoms, but rapid recurrence is the rule, and the writers expressed their disbelief in the possibility of a radical cure. The other cases published in the literature show also the same post-operative evolution. Pousson in a series of 7 cases, has 1 without recurrence after one year, and he lost track of

2, one after eighteen months, and the other after two years, also without recurrence at that time.*

Dr. Young's results are not *prima facie* any better than these which have been obtained with a method that cannot be adjudged a radical operation. Does this uphold the contention Pousson put forward in a recent letter, namely, that since the cancer is limited, a large excision is not necessary, a contention absolutely contrary to all the general principles governing the surgery of malignant lesions? Or does it not rather demonstrate the shortcomings of the theoretically more radical operation?

We may conclude, therefore, first, that the knowledge of forms of transition between simple senile hypertrophy of the prostate, and prostatic carcinoma, has not solved all the problems of an early diagnosis; secondly, that the clinical evolution of the disease and its anatomical characteristics are not such as will enable us to hope that a radical operation will be some day devised, and that, thirdly, abstention is the wisest course, because of the old rule: *Primo non nocere.*

In this we quite agree with Dr. Belfield when he says: "As long as prostatic carcinoma is limited within the capsule, it can be extirpated, but the operation is bloody and severe and the results a doubtful compensation."

## CONCERNING THE PRACTICABILITY OF KIDNEY TRANSPLANTATION

By GEORGE WHITESIDE, M. D., of Portland, Oregon

IN spite of the remarkable achievements of modern surgery, how often we find ourselves confronted by a situation which we cannot overcome. I refer to those all too frequent cases of advanced disease which place the patient beyond our skill. In cancer, sarcoma, cystic degeneration and advanced tubercle we see many unfortunate patients whom we cannot help. We are apt to throw the burden of responsibility for such cases on the long

* Loumeau published a case recently and expressed himself as thoroughly satisfied with the result, but only *eight months* after the operation.

suffering shoulders of the general practitioner. We point out to him, the perfectly obvious truth, that if the surgeon had been called in earlier, before the disease had become so extensive, before essential organs were involved, a skillful extirpation would have prolonged life or even would have been able to completely cure. I fear such criticism is too often merited, but such is by no means always the case. Soloman said there are three wonderful things, "The flight of a bird through the air, the path of a fish in the sea and the way of a man and a maid." He might have added a fourth, namely, the manner of the first beginning of a malignant disease. It is insidious, it is obscure, it often escapes the most skilled diagnostician. In many cases the signs are atypical and the symptoms slight until the disease has a firm foothold. Of no organ is this more true than the kidney.

Renal new growths or infections generally have far advanced before their true nature is determined. As a rule one kidney must be removed entire and frequently the other side is also diseased.

Theoretically, it would be a great advance in renal surgery, if, after nephrectomy, a sound kidney might be substituted for the diseased one. Consider, for instance, a patient with a tuberculosis of both kidneys. One is generally more extensively invaded than the other. It is clearly impossible to remove both. Suppose it were possible to extirpate the more diseased one, replace it by a sound kidney from a dog or a sheep and have such a transplanted kidney functionate sufficiently so that at a later date the patient's other infected kidney could be removed and a second sound one substituted. Such an operation, although essentially radical, would be truly conservative; even though the mortality were high it would be a beneficient procedure. Think of the triumph for surgery in curing those who formerly were considered incurable. The operable case of to-morrow is the inoperable case of to-day. All advance in surgery in the past has been of this kind. My theoretical idea may seem fanciful to us now, but presently it will be a universal practice.

Such is my idea. Let us see what has been done already and consider what further experiments must be undertaken to complete the evidence to prove it practicable.

The problem is this:

1. The removal of the diseased kidney.

2. To obtain a sound kidney from an animal.

3. To introduce this foreign kidney into the circulation that it may receive nourishment and live.

4. The permanent functional ability of such an engrafted kidney in its new position.

1. The removal of the diseased kidney—nephrectomy is easily practiced and often successful. This is universally accepted.

If a normal, sound kidney should be removed the mortality should be zero. Such an operation is, however, never performed. Rovsing reports the results of his own nephrectomies (1). Rovsing, Casper, Israel, and others have lately maintained that by properly selecting cases for nephrectomy the mortality should be very low. The cases should be carefully observed and cryoscopy of the separated kidney urines performed. They should also be subjected to the phloridizin test. In this way the condition of the supposedly sound kidney may be more accurately determined and operation refused to those with two very much diseased organs. In this way (by selection of "operable" cases) Rovsing (2) has reduced the percentage of deaths in his clinic from 13% to 3%. In more closely analysing Rovsing's report we find that he had 5 deaths in 31 malignant cases (16% mortality), 9 deaths in 47 tubercular cases (6.3% mortality) and 1 death in 11 cases of pyonephrosis (ætiology not stated except that cases complicated by kidney stones were not included). At the same time he cites 900 cases operated upon between 1895 and 1905 and reported by Schmieder. In this series the average mortality is 29%. It is not stated whether any of the more recent of these 900 cases were tested by phloridzin and cryoscopy or not; presumably not, otherwise the mortality would have been lower.

We may say that these statistics seem to assign to nephrectomy, under the best conditions, a mortality of 3% and when the cases have not been so carefully selected a mortality of 29%. In either event it is not an operation to be rashly advised, but is a serious and mutilating one which should be gravely considered before being undertaken.

Therefore, let us consider the more conservative operation of nephrotomy. V. Bergmann says (3) "the surgery of the kidney has been growing gradually more conservative. . . . Czerney, in 1886, resected a portion of the kidney in which an angio-

sarcoma developed after a fall. He closed the wound partly by suture and partly by gauze. The wound healed well.

". . . Experiments upon animals show that portions of the kidney can be resected and the wounds, if sutured, heal by primary union. In the last 15 years many cases of resection have been reported. . . . Israel has removed nearly one half the organ with success." In malignant disease, where the growth is encapsulated or discreetly localized and confined to a portion of the organ, in tubercle under the same (rather exceptional) circumstances, in simple cysts, blood cysts, hydatid cysts, in hydronephrosis where back pressure has partially destroyed renal tissue, we have choice of nephrectomy, nephrotomy and resection of the diseased or useless portion or simple aspiration of the products of disease or hemorrhage.

Nephrectomy is contraindicated if the other kidney is unsound also. This is shown by such statistics as are quoted from Rovsing's report (4). Nephrotomy and resection of the focus of disease or injury followed by suture of the wound of the kidney offers a safe and reasonable method in those cases where it is possible to do this operation.

In order to show the method of healing of such a wound I excised, in a rabbit, a wedge-shaped section which was approximately one-third of the kidney and replaced it by a freshly cut wedge of similar size and shape from another animal.

Seven weeks later the rabbit was killed and the kidney removed. In the photograph the arrows point toward the cortical margins of the wedge of foreign tissue. The cut surface shows a line of cicitrization on each side of the wedge, but the structure of the renal tissue of the wedge is normal. This is borne out histologically. Transverse nephrotomy was done following Herrman's idea (5). Herrman performed experiments on dogs and proved that transverse nephrotomy does not damage the kidney tissue to the same extent that longitudinal nephrotomy does. He showed that the latter produces extensive infarctions and the formation of much interstitial tissue. Therefore, transverse nephrotomy is preferable. It has been stated that hemorrhage is greater in transverse nephrotomy, but if the wedge of new renal tissue is quickly inserted and its margins accurately sutured to the margins of the kidney wound, hemorrhage is not sufficient

PLATE XXVI.—Presented by Dr. George Whiteside.

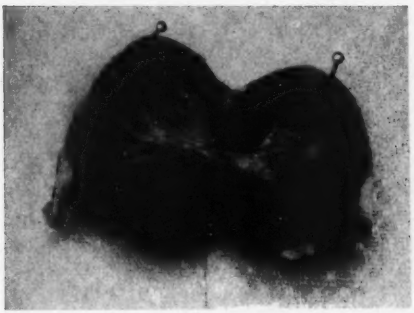

FIG. 1.

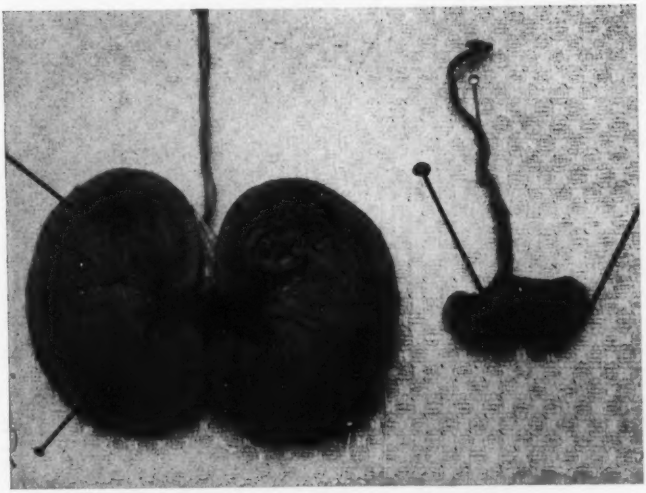

FIG. 3.

to be of importance. Four experiments on animals and one operation on man have convinced me of this. My transverse nephrotomy on a man was not done for degeneration of renal tissue, but merely to remove a stone from the renal pelvis. In this case the operation was entirely satisfactory.

The third method of treatment of diseased kidneys applies especially to cysts. That is tapping through the lumbar region either for simple aspiration or aspiration followed by the injection of some liquid, such as tincture of iodine or carbolic acid into the cyst cavity. This method leaves much to be desired. It is styled conservative largely because our grandfathers practiced it, and it cannot be considered a novelty. Maisonneuve reported (6) a case of hydatid cyst in which he tapped the cyst, evacuated the fluid and injected tincture of iodine. The patient died three days after the tapping, apparently of sepsis. Now-a-days the sepsis would have been avoided, but I do not think any modern surgeon would advocate such a procedure except for diagnosis—not treatment.

If, then, a portion of a kidney is diseased, one or the other of two courses are usual. Either excision of the diseased portion, bringing the normal fragments of the kidney together and suturing them as nearly as possible in apposition, or else the still more mutilating operation of nephrectomy.

It is essential to success in nephrotomy that the other kidney be of normal functional ability or else that the portion removed be so small as to leave sufficient good renal tissue to carry on the urinary function for the body. It is essential for the success of nephrectomy that the other kidney be sufficient. This fact is a grave limitation of these two therapeutic measures. If it were possible to excise the disease and by transplantation of renal tissue from some animal to leave the patient with more excretory tissue than before the operation, as much or nearly as much as he normally possesses, what a great advantage would be gained. On animals this is possible, as shown by my experiments. In all, four rabbits were operated upon. The results were identical. The new tissue united by primary union with the cut surfaces of the kidney.

The repair of renal tissue is thus described by V. Bergmann (7). "On account of the system of terminal arteries which exists

in the kidney, the effects of traumatism are severe. . . . Compensatory hypertrophy of the kidney takes place without the formation of new glomeruli. If an arterial trunk is injured there follows a well marked pyramidal necrosis of the tissue supplied by it. . . . Even the cells of the capillaries undergo fatty degeneration." Such a degenerative change certainly does take place to some extent, but I think the picture of tissue loss an exaggerated one. Certainly if it were constantly and invariably the case the implantation of a portion of renal tissue from one animal to another would absolutely fail to introduce new tissue capable of any excretory effort. I believe the new tissue implanted in rabbits' kidneys in my four experiments capable of function. Microscopic examination revealed the production of some cicatricial tissue along the line of union but failed to show any great excess of interstitial tissue in the grafted renal tissue, certainly not enough to block all its tubules. Many of the terminal capillaries in the glomeruli were normal in appearance although others were filled with the products of retrograde metamorphosis. Therefore, I believe this procedure actually does add renal tissue in place of that excised.

The limitation of this operation in practice must always be that only those cases are suitable for such a method in which a portion of the kidney is diseased or destroyed. I have never yet had the opportunity to try it on a man, but I should not hesitate to do so in a suitable case. The technic of this operation should be as follows: Having exposed the kidney and drawn it up into the lumbar wound in the usual manner the diseased portion should be cleanly excised with the scalpel. If hemorrhage is severe the renal vessels may be gently compressed between the blades of a clamp covered by rubber tubing. The cut surface should be bathed in warm (not hot) saline solution. The piece of renal tissue may now be obtained from the kidney of a living animal (dog preferred). Its size and shape should be as nearly as possible similar to the sacrificed piece in the patient except that it may be a little larger. Wash the piece to be implanted in warm saline solution, fit it in place and suture it there with very finest silk sutures and a small round needle. The sutures should be placed about 1 cm. apart and need not extend deeply into the cortex but should include the cut edges of the capsule on both sides of

PLATE XXVII.—Presented by Dr. George Whiteside.

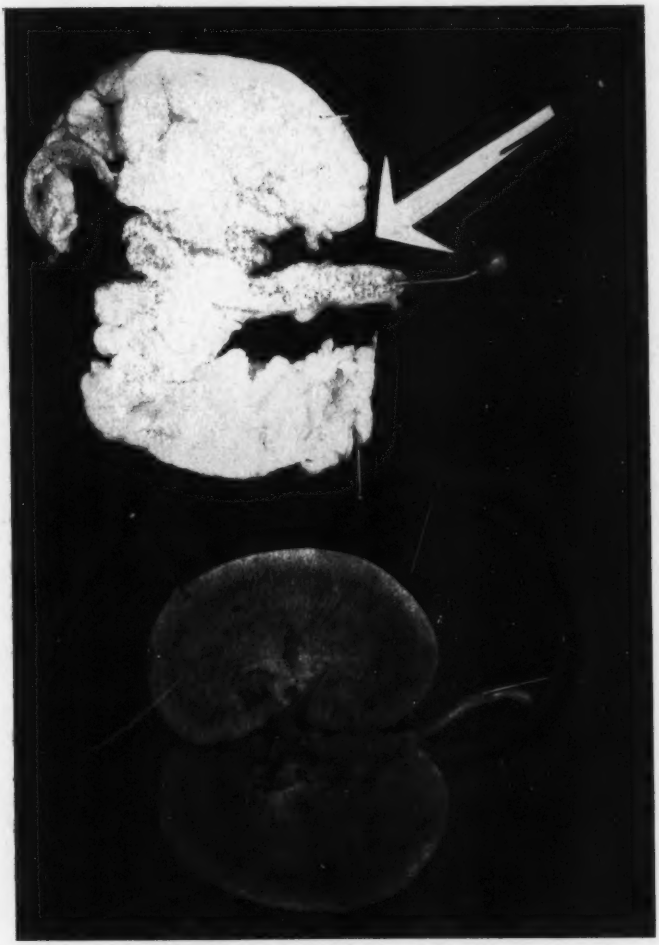

FIG. 2.

the incision. As soon as the piece has been fitted and sutured in place there is no further danger from hemorrhage.

Whatever the extent and shape of the original diseased area in the patient's kidney the excision should be done in such a way that the portion of the pelvis into which the cut tubules empty be excised also. In this way the new piece added from the animal is entire in itself. Its functional ability, later, is not dependent on the accident of the open cut ends of some tubules happening to become accurately approximated. Even when it is forever differentiated from the patient's original kidney tissue (as is shown in the photograph of rabbit No. 3 inserted above) its functional ability depends solely on the life of the tissue. This, in its turn, depends on the establishment of circulation on the grafted tissue by the extension of blood vessels into it from the cut surface of the remainder of the patient's kidney.

Such an operation, as a practical measure, is not entirely founded on fancy and theory. Animal experimentation shows it possible in beasts, why should it not be possible in the human animal? In one of my four rabbits thus experimented upon (rabbit No. 4) the right kidney was thus nephrotomized and a piece implanted. Six weeks later the left kidney was entirely extirpated. The animal lived five weeks and was in good health when killed. Its kidney was so similar to that of No. 3 that I considered one photograph showing such a condition sufficient to demonstrate every other example in my possession. However, animal No. 4 (just referred to) proved to me the sufficiency of the kidney into which a piece had been grafted or implanted. The piece, in this case, was originally 6.27 grams in weight. At autopsy the entire right kidney (containing the graft) weighed 17.45 grams, but it must be remembered that this weight was taken five weeks after left-sided nephrectomy. Consequently the right kidney had gained, in all probability, 2.50 or 3. grams by hypertrophy when there was physiological need of its increase. Probably at the time the graft was placed it was almost, if not quite, one-half as heavy as the remnant of kidney into which it was implanted.

In this place it is of interest to consider the work that has been done with regard to the collateral circulation of the kidney. Since nephrotomy and grafting of renal tissue into a kidney with vessels

normally attached is possible, the question at once presents itself as to whether the collateral circulation is sufficient to nourish a whole kidney where the renal artery or vein or both has been tied off.

It has long been held, as the result of clinical observation, that occlusion of the renal artery from rupture or aneurism will produce necrosis of the kidney. Morris states (8) ". . . death of the part involved does not necessarily follow occlusion of a branch." In making this observation he implies that death of the organ would necessarily follow occlusion of the main artery. No other authority is at variance with this opinion. However, we do not have to depend entirely upon clinical observation in cases of rupture or aneurism for Michel Jungano has published two excellent papers, (9) one on ligature of the artery and one on ligature of the vein. His experiments were on dogs and rabbits. In every instance death of the organ took place followed by necrosis and complete atrophy of the renal tissue. He thus describes the process after ligature of the artery.

"Twenty-four hours after operation the kidney is swollen, the external surface blue with brown patches. On section bloody serum exudes. The cortical tissue is conjested while the medullary tissue is anæmic. The capsule is entirely detached. Œdema causes the kidney to weigh one-half again as much as the other.

"*Histological Examination.*—The general appearance is normal, but in spots there are great changes. Many of the Malpigian bodies are affected while others appear nearly normal. The vessel tufts of the glomeruli are swollen so as to completely fill the semilunar space. Much of the epithelium of the capillaries is detached by œdema. In other places the endocapsular space is filled with an amorphous granular material probably derived from coagulated albumin and cell detritus. This substance is often so great in amount that the glomerulus is compressed and pushed to one side. In consequence of this, degenerative changes have already set in. The epithelium has become granular and separated from its basement membrane, causing occlusion of the finer capillaries and the same process obstructs the tubules. The tubules in the cortical tissue are affected so that it is impossible to see the outlines of the degenerated cells. Their protoplasm has become hyaline with granular specks in it. Many tubules are filled with

hyaline and granular detritus, forming a cast which occludes the lumen. Grave alterations have taken place in the epithelium of the convoluted tubules and of Henle's loops. In many places one sees a capillary congestion and the veins are dilated and full of blood, while the arteries are empty."

Such grave changes, observed after 24 hours, can only progress to their logical end.

The examination of another kidney four months after ligature of the artery shows the final result. Quoting from the same author he says: "the kidney is shrunken, irregular in shape, has a hard, gray-yellow, granular surface. In cutting this kidney it is found to be nearly as hard as bone. The cortical tissue is occupied by a yellow substance, the medulla is white. The kidney weighs one-half as much as the other one. Histological examination shows "calcified tubules." Connective tissue has been formed between the groups of cells. This is a step toward organization. The collecting tubules are completely occluded. In fact the organ is being converted into a fibrous mass of connective tissue. Functional activity is no longer possible. We may conclude from animal experimentation that clinical observation is correct. Occlusion of the artery caused complete death of the organ.

The results of Jungano's researches on ligature of the vein are also interesting. First congestion, then œdema, then necrosis, absorption of the products of necrosis and complete atrophy of the organ. That in brief is the picture.

In Edebohl's operation for contracted kidney it has been claimed that the new capsule formed about the decapsulated organ was, at first, very vascular and since Jungano has shown us not to expect anything of the collateral circulation when the kidney capsule is intact may we hope for better results after decapsulation?

I have tried to answer this question by performing experiments upon rabbits. Rabbit No. 1. July 14, 1906. Left kidney exposed. Renal artery tied off. Kidney completely decapsulated. Right nephrectomy three weeks later. Death the next day. No urine in bladder. Autopsy shows left kidney one-half normal size and the macroscopic and microscopic findings so closely corresponded with Jungano's experiment above quoted that it is not worth while to describe them.

Rabbit No. 2. July 17. Ligature of left renal artery after complete decapsulation and stitching the kidney into the wound, but covering it with muscle tissue. Rabbit killed 14 weeks later. Result is entirely in line with the other case. The left kidney is useless. Most of it has been converted into fat. A small portion of kidney tissue, entirely degenerated and useless, remains at the upper end of the ureter.

The normal, sound kidney from the other side is shown with the fatty degenerated one. This is somewhat larger than normal in consequence of compensatory hypertrophy. I think we may conclude from these experiments that no collateral arterial circulation is encouraged by decapsulation.

On August 20 I performed the operation of tying the renal vein in rabbit No. 5 after decapsulation of the kidney. No better result was obtained. The accompanying photograph shows the final result. Complete atrophy of the kidney followed by absorption (as described by Jungano) so that the organ is represented by a small knob of fibrous tissue at the upper end of the ureter.

Decapsulation, then, does not help at all in the formation of new blood vessels. I state this in spite of the hope held out by the results of Zaaiger's experiments (10) which led me to undertake mine. He says "A new capsule is formed after both decapsulation and sacrification of the kidneys of animals, which insures better circulation for the organs than is the case with the normal kidney. By the end of from four to six weeks, both the arterial and venous anastamosis is more effectual in securing freedom of blood circulation than in the normal organ. There is usually more or less adhesion of the fibrous capsule in those cases upon which the operation has been done."

The next step in our investigation leads us to consider anastamosis of the renal artery and vein with a view to complete transplantation of the kidney.

End to end anastamosis of arteries was first put on a practical basis by Murphy of Chicago who demonstrated, by experiments and afterward by an operation on a man, the feasibility of suture after complete division (11). Murphy attained the desired result, after division of the femoral, by invaginating the proximal into the distal end and suture of the margins. Martin refers to Murphy's case and says it "Still remains the most striking prac-

tical demonstration of the practical utility of the method." Most attempts at the suture of arteries have been for lateral defects and not end to end anastamosis. Many operators have reported such cases. E. Martin reports the closure of a tear into the femoral artery (12), F. F. Stewart recites a similar case (13), and R. H. Harte another case (14). These serve as examples. It is unnecessary to cite other instances since they only indirectly concern us here.

George Brewer of New York contributes valuable experience to this subject (15). In attempting to suture a wound of the external iliac artery he encountered many difficulties. The sutures repeatedly failed to hold in consequence of "the high intra-arterial pressure and the force of the systolic impulse, both of which tended to separation of the approximated edges." This observation seems to me of very great practical importance to us in our present paper and I will refer to it again when I come to speak of the work done by Carrell and Guthrie.

The result of Brewer's clinical experience was that he, later, undertook experiments to see if he could prevent hemorrhage from a sutured artery, or even could bring the ends of a divided artery into place and keep them there without stitches. This he attempted by means of adhesive rubber plaster manufactured for him by the surgical supply house of Johnson and Johnson. He succeeded in accomplishing this purpose on dogs by exposing and dividing the artery and after drying the outside of it with a swab saturated in ether he rolled the adhesive plaster around it. This acted not only as an envelope, but also exercised some elastic compression. It seems to me this method might be adapted to anastamosis of the renal artery, but I have never tried it.

Discussion of Brewer's paper and also of Edward Martin's paper above referred to, brought out some interesting facts. Among others it was stated that "experience had failed to demonstrate a single case of aneurism after suture of the large arteries," also "the absence of secondary hemorrhage" and the comparative infrequency of thrombosis.

Hubbard collects 20 cases of arterial suture (16) and states (quoting Dorfer) that sutures which include the intima are easier to apply, quicker, and do not involve a greater risk of occluding the vessel by thrombosis. This is important because it was

formerly held that the stitches should never penetrate the intima.

Garré, of Breslau, reported to the Hamburg Scientific Society (17) cases where small vessels were cut and a section, even 6 cm. long interposed between the divided ends, from another animal. He has long successfully accomplished this in man. He approves Murphy's technic.

Carrell and Guthrie report a method (18) which they call the "patching method" for anastamosis of small arteries. It is based on the principle originated by Maydl (19) for implantation of the ureter into the sigmoid flexure. Carrell and Guthrie cut an elliptical piece from the wall of the aorta in the center of which the renal artery took origin. This elliptical piece was implanted into a hole of suitable size and shape, made to receive it, in the aorta of another animal and sutured in place. They claim that this method is easier, safer, and less liable to extensive thrombosis than end to end suture of the renal artery. This is at variance with Brewer's experience referred to above. I have twice attempted this operation. Once on a very large rabbit and once on a medium sized dog (mongrel collie). In the rabbit I did not get far. After clamping the inferior vena cava, preparatory to excising the elliptical patch containing the renal vein, the rabbit's heart failed and he died within a few minutes. Possibly gradual compression should have been the method instead of rapid, complete compression with a clamp. At the Section of Surgery and Anatomy of the 57th annual meeting of the American Medical Association, Halstead read a paper (20) on "The Results of Complete and Incomplete Occlusion of the Abdominal and Thoracic Aortas by Metal Bands." This very interesting and valuable article shows the dangers from secondary hemorrhage in complete occlusion and the fact that partial occlusion finally leads to complete occlusion of the artery. Halstead was not interested in the vein and consequently makes no reference to it. Whether sudden complete clamping of the vein, thereby greatly diminishing the quantity of blood entering the heart, caused the death of my rabbit, or whether death at that precise moment was a mere coincidence, I cannot say. The reason why I never tried the procedure again will appear later. In my dog I attempted anastamosis of the artery first. I found it impossible to make a tight joint. Hemorrhage was so

considerable that death finally resulted. I do not know why Carrell and Guthrie were successful with this operation and I was not. It may be greater technical skill gave them an advantage which I can never compete with. Be this as it may, I have been able to anastamose an artery by the invagination method. I am, therefore, partial to this procedure and believe it to be the most generally applicable to the renal vessels.

All this applies to our present inquiry by demonstrating that it is possible to suture arteries successfully by several methods, end to end anastamosis, invagination, and possibly the "patching method" of Maydl, Carrell, and Guthrie. Similar evidence could be obtained in regard to venous anastamosis, but I think it unnecessary since the artery presents the greater difficulties. Anyone interested in it will find a very complete article by Carrell and Guthrie (21) which gives a history of the method and also a complete bibliography.

Our next step should be to show the practicability of the transplantation of organs from one animal to another. We all know that the ovary has been transplanted in both animal and human subjects. Portions of the thyroid gland have also been engrafted to the neck and to the spleen. It has been proved (22) with these organs that the theoretical objection of the hæmolytic action of the animal blood in the transplanted organ is not a practical objection. As a matter of fact the quantity of animal serum thus introduced is so small that no evil result ensues. Carrell suggests (23) that it may be a good thing to unite the proximal cut end of an artery to the distal cut end of a vein, since "the caliber of the vein of a gland is always much larger than the caliber of the arteries, it is probable, though unproven, that the amount of blood flowing through the gland will be increased" by the anastamosis suggested. If the blood flowing through a transplanted organ can be increased, temporarily at least, it increases the chances that the transplanted organ will live.

It has been theoretically urged by some that section of the nerves of the kidney would cause either death, atrophy, or at least cessation of function. This does not appear a practical objection. Section of the nerves of the kidney has been done experimentally in the study of diabetes insipidus. The result has been dilatation of the renal vein, but no very grave disturbance of function except

polyurea (24). The dilatation of the blood vessels is an advantage rather than otherwise toward the accomplishment of our present purpose.

Anastamosis of the ureter is a well recognized proceeding in surgery. One reference is sufficient. Many others might be added. Binnie of Kansas City gives all methods briefly (25). Many methods are good and satisfactory.

It, therefore, only remains to show that the kidney may be transplanted and live and also that functional activity is not only possible but sufficiently satisfactory. I do not claim that either of these positions can be entirely satisfactorily proven at the present time, but such success has been attained to make it probable that they will be demonstrated conclusively in the near future.

The earliest article on the subject which I can find is by E. Ullmann (26). His method of procedure was as follows: The carotid and jugular were freely exposed in the neck and were clamped off with forceps on both sides of the wound. The vessels were then severed and prepared for vascular anastamosis after the method of Payr, which consists in using small magnesium tubes. One-half of each tube is smooth, while the other half bears two grooves. These tubes are intended to fit inside the lumen of the vessels. After extirpation of the kidney, the ureter was exposed and freed for several centimeters and was then severed. The renal vessels were cut as close to the aorta and vena cava as possible. The renal vein was invaginated into the jugular and the renal artery into the carotid. A continuous suture held each in place. The forceps were then removed, first from the vein and then from the artery. The blood flowed through the kidney immediately and shortly after that urine came from the ureter. After making a place for the kidney by dissecting off the muscles from the subcutaneous tissue, the kidney was sewed in, and the skin was closed with the exception of a sinus left for the ureter.

The flow of urine continued from the ureter for five days. Then, either the ureter was obstructed or the fistula became closed from the dog's scratching. Urine no longer ran freely, but by drops, from the wound.

At the meeting, June 27, 1902, of Thek. K. Gesellschaft der Arzt, Ullmann showed a goat, in which the kidney of a dog had been transplanted into the goat's neck. He expresses his prefer-

ence for transplantation from one dog to another and at that time intended to continue experimentation. I am, however, unable to find any further report of his work. Since 1902 experimenters using Payr's method of anastamosis have found the tubes very liable to promote thrombosis of the vessel. From all other points of view they very greatly facilitate the operation (27). Garré reported a case of successful experimental kidney transplantation in September, 1906. In Carrell's article in the *Journal of the American Medical Association*, November, 1906, (28) above referred to, he implies, but does not distinctly state, that he also has transplanted the kidney. He gives no definite proof that the experiment was successful.

I have attempted kidney transplantation experimentally. I first used rabbits for my experiments, but soon found that the renal artery in a rabbit is less than 1 millimeter in diameter and the vein not much larger. The technical difficulties involved in the suture of such very small vessels prevented my accomplishing my purpose. My first operation on a dog proved disastrous. He died of hemorrhage. My second died of sepsis. My third died of sepsis following thrombosis of the renal vessels. My fifth died from some obscure and unknown cause five days after the operation. Autopsy failed to show evidence of a successful transplantation. The circulation had never become properly re-established in the kidney. The capillaries were occluded by thrombi and the detritus of degenerative changes. My sixth dog died from effects of ether. The seventh developed peritonitis. My eighth was operated January 20, 1907. It is now (February 10) 22 days since operation and he seems to be all right, but I will not be able to prove that the transplanted kidney is living and functionally active until some weeks later. In this case I did an end to end suture of the renal artery with the renal artery, the renal vein with the renal vein and the cut ends of the ureter with each other. Silk was used as the suture material. No attempt was made to avoid the intima. It was possible to slightly invaginate the proximal into the distal stump of the renal artery, but the vein was a simple end to end circular suture. In spite of my many failures I still have faith and believe the operation possible. The few successes reported encourage us to expect improvement in technic. I think we have, in this paper, reviewed all objections to the operation. Expe-

rience will develop skill and ingenuity will overcome technical difficulties.

I firmly believe Carrell has pointed out the most frequent cause of failure when he warns us against sepsis. Asepsis seems to me to be essential to success in this operation upon animals. Rabbits and dogs are so resistant to micrococci that experimenters often grow careless and do not keep to a proper standard of surgical cleanliness. I have committed this mistake myself several times. Some of the deaths due to sepsis are mentioned here. Animals stand infection well, have a high resistance, recover and get entirely well, but the integrity of the sutured blood vessels and ureter and their freedom from occlusion by thrombosis must be considered. Local sepsis will certainly cause arterial and venous thrombosis in the vessels in the immediate neighborhood of the affected area. Thrombosis means certain failure in this operation.

Carrell also conservatively warns us against being carried away by enthusiasm. Not all operations possible upon dogs are possible upon man. When we have succeeded in transplanting the kidney experimentally with a reasonable degree of success, when the mortality of the operation in a healthy dog is not over 50%, for instance, we must remember that this does not mean that the same conditions prevail and the same results will be attained in man. The first operation on a man will be in the nature of an experiment. I want to be plainly understood in this. I have never tried it. I do not think experimental work along this line has yet been sufficiently successful to warrant an experiment upon man. Some time, however, and that time is not far off, greater advance will have been made and the time will be ripe for the first operation of the sort on man. I firmly believe this procedure will be developed and placed upon a solid basis before many years have passed. Then what a triumph for surgery! Let us hope that an American surgeon will perform the first kidney transplantation in the human subject.

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# Addenda

## THE PRESENT STATUS—TWO YEARS AFTER THE ORIGINAL REPORT—OF EIGHTEEN MALE CASES OF RÖNTGEN RAY STERILITY*

By F. Tilden Brown, M. D., and Alfred T. Osgood, M. D., of New York

In January, 1905, we found that a number of men who had been long exposed to the X-ray, were the subjects of azoospermia and for the purpose of warning others who might be injured, we made an announcement of this before the section on Genito-urinary diseases of the New York Academy of Medicine in the latter part of that month. Later in the year we published a more complete report upon our investigations into this subject, mentioning eighteen cases which we had found to have no spermatozoa or a very few morbid spermatozoa in seminal fluid.

In that report we said, "Repeated, prolonged exposures of the testis to the Röntgen Rays does produce sterility in the human being"—and this we still hold to be a statement of fact.

We said further that the question of prognosis would have to remain in doubt until evidence could be collected in regard to the recuperative power of these organs after months or years and that it was reasonable to suppose that some of the spermatogenetic cells had escaped this blighting influence in many cases where precautionary measures had been employed and when exposures had not been protracted or frequently repeated; moreover, we believed that some might have escaped in spite of great exposure.

Note: The articles in this and the succeeding papers were necessarily omitted from the earlier parts of this volume.

* Presented at the first day's meeting.

Now after two years we report upon these same cases and find that some have escaped permanent injury (doubtless because of subsequent avoidance of exposure) and that some cases whose records were bad at that time are now the fathers of children.

The warning given two years ago has, we believe, had a salutary influence so that few workers with Röntgen rays have been careless in regard to this sort of exposure since that time.

From the studies of others as well as from our own experiments with animals and our study of these cases, we believe that the extent of this injury is directly proportionate to the amount of destruction of spermatogentic cells in the tubules of the testis.

Inspection of the photomicrographic reproductions of sections made of the testis of the white rat after quite long exposures to X-rays will demonstrate why it is that restoration of normal structure and normal function in a part of the organ so changed is inconceivable. All of the several layers of spermatogenetic cells have disappeared—a few scattered nuclei and a few of the cells of the lowest layer persist—the rest are broken down into debris and viscid fluid.

There are many features of this condition which are not clear, yet we possess some positive facts and from them we may draw some reasonable inferences: we know that this condition can be produced in animals; that it requires a considerable exposure to a ray of moderately high penetrative capacity and that evidence points to a cumulative effect brought about after a number of exposures. Spermatozoa themselves are highly resistent to X-ray exposure, being unaffected by exposure for many minutes to large doses.

The spermatogentic cells of the tubules show degenerative change after exposures.

No estimate can be given as to the amount of exposure necessary to bring this condition about in man. Others have reported upon the approximate time required to produce it in the rabbit, guinea-pig, and the rat, but we can by no means measure the amount of X-ray to which any of these individuals has been subjected.

There seems to be no direct relation between the cutaneous effects and those in organs beneath the skin, *i. e.*, some men who have had marked chronic dermatitis have given evidence that

PLATE XXVIII.—Presented by Dr. Alfred T. Osgood

FIG. 1.—Normal testis of rat

organs beneath the skin functionate normally, while others who present no cutaneous lesions have suffered otherwise.

The eighteen cases reported two years ago represented fifteen cases in whom *no* spermatozoa could be demonstrated and three cases whose seminal fluid showed a very few motionless spermatozoa (obligospermia).

Two of the cases of azoospermia (1905), have given us no subsequent opportunity for examination.

Of the remaining cases, thirteen in number, which in 1905 we believed to be subjects of azoospermia, nine are shown now (1907) to be subjects of azoospermia; two have recently shown a large number of motile, normal-appearing spermatozoa in seminal fluid, the two others have improved so far as now to present seminal fluid in which after diligent search a very few spermatozoa could be found.

The three cases of oligospermia of the 1905 report are apparently normal now.

Two years ago we received reports from a number of others whom we had not personally examined which were not included in our report and we examined several men who had undergone what we considered little exposure who were in normal condition.

A surgeon who investigated this subject in 1905 following our announcement has sent us the result of his examination of eighteen cases among physicians, surgeons, dermatologists, physiologists, electricians, and experimenters who had employed the Röntgen rays in various ways. Of these only five were in 1905 cases of azoospermia and among these five cases two have improved now in 1907 so as to present a few spermatozoa.

Eight of his cases worked without precautions. The ten others were said to have been "careful to avoid proximity to the tube," "careful to stand behind the target," to have taken "moderate precautions," or to have been "very careful."

Such cases as these ten of our friend's report we did not include in our list. To quote our report (1905) again "twelve of our cases had operated X-ray tubes for one-half to four hours at a time at least as often as three times a week for the greater part of each year during the past two to six years." "All who have done extensive X-ray work for several years (more than three) show no spermatozoa in their seminal fluid, while a few of the

men who have been engaged in the work for a shorter time and have exercised care in avoiding direct exposure to the active tube show varying states of oligospermia."

What was said two years ago can be said now that "in no case has there been evidence of deterioration of sexual activity."

## DISCUSSION

Dr. EDWARD L. KEYES, Jr., of New York, thought this a most important subject, and most interestingly presented. He asked Dr. Osgood whether he considered the improvement in some cases due to precautions which were not taken by some who did not improve, or whether he had seen improvement occur in men who continued to do the X-ray work without precautions. In this regard, he said, it might be of interest to detail a very interesting report made by Dr. Lapowski of New York. This was a case of eczema of the anus, which, resisting other methods of treatment, was sent to be X-rayed, with a knowledge of the danger of sterility. He therefore had especially specified that the man's testicles should be protected by a lead screen. The patient's semen was twice examined before the first application of the X-ray, and living spermatozoa found in great numbers. The X-ray was applied three times. At the end of that time he returned and the semen was again twice examined, and found to contain a few dead spermatozoa. He was then exposed three times more, and two more examinations of the semen showed no spermatozoa whatsoever. He then was taken off the X-ray treatment, and three months later his semen was again twice examined, and found to be full of motile spermatozoa. Apparently the restoration was immediate and complete.

Dr. L. BOLTON BANGS, of New York, said that since this subject was presented by Dr. Brown some physiological questions had presented themselves to his mind, and he would like those who had made the observations, and Dr. Osgood in particular, to throw some light upon the subject. He asked whether during the disappearance of the living spermatozoa there was also an associated loss of sexual desire, and also whether there was an associated loss of the power of intercourse. It seemed to him that these questions had rather an important bearing, and that they should be answered with definiteness. Dr. Osgood, he understood, said indefinitely that there was no permanent deterioration in sexual capacity.

Dr. FRANCIS R. HAGNER, of Washington, D. C., said there was a case in Washington that had come under his observation, that of a doctor who had done considerable X-ray work. He had been married nearly two years and

PLATE XXIX.—Presented by Dr. Alfred T. Osgood.

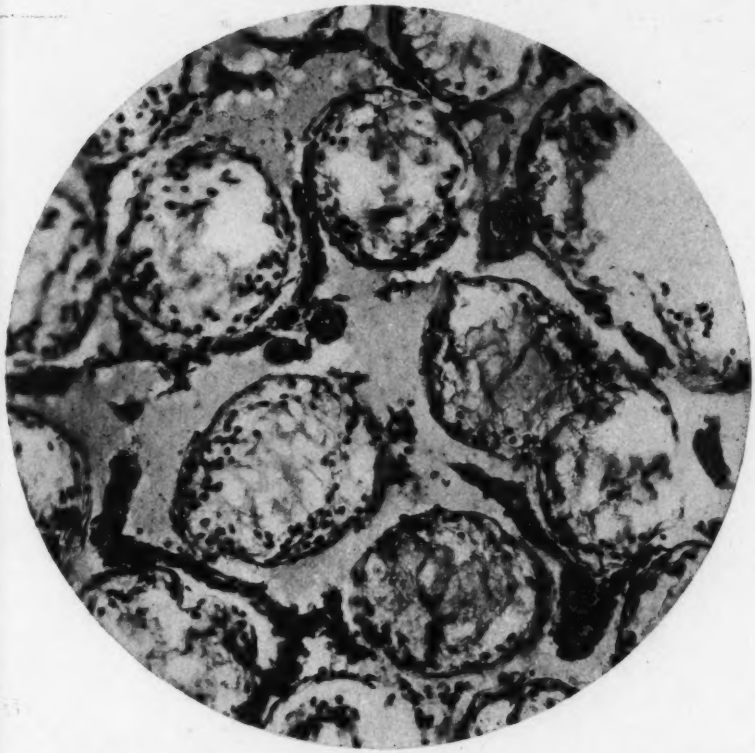

FIG. 2.—Left testis of the same rat after repeated, prolonged exposure to X-ray. Treated 15 minutes daily during April and May, 1905. Killed Nov., 1905. No evidence of inflammation. Simple destruction of spermatogenetic cells and atrophy of tubules.

his wife had not become pregnant. The physician himself had examined his seminal fluid and found no spermatozoa. Four months from the time he began to use a lead apron for protection during his X-ray work his wife became pregnant.

Dr. OSGOOD, in closing, said there had been no evidence of sexual deterioration in any form. They still retained the sexual desire and the power of intercourse. He thought this a very important question, and we should have as much information in regard to it as possible. He could see how it might be applied for the relief of certain conditions in married life, which were sufficiently obvious. As to the question asked by Dr. Keyes, every man they knew of had used precautions since that time. He reported a case to show the physiological condition. A man who began X-ray work in 1905 did a great deal of it for six months without any precautions. In February, 1905, he knew that spermatozoa were present in the seminal fluid. In June, 1905, the examination showed a very few. Several examinations in September and October of the same year showed absolutely no spermatozoa, and examinations were then made once a month until April, 1906, and no spermatozoa were found at any time. Subsequently to that for three months the examinations disclosed a few spermatozoa. After July, 1905, he was using very careful precautions, and not until after April, 1906, did he find any spermatozoa, and then only a very few were found. In August, 1906, his wife became pregnant, and since that time a very few had been found on repeated examinations. In one of the cases which had improved to the extent of finding a few spermatozoa, three different men each made an examination, and each found one spermatozoon. In reply to a question by Dr. Bangs, Dr. Osgood said there had been no effect on the minds of these men. There seemed to be some question as to the amount of protection employed in Dr. Lapowski's case. He thought the patient was exposed several times without any protection.

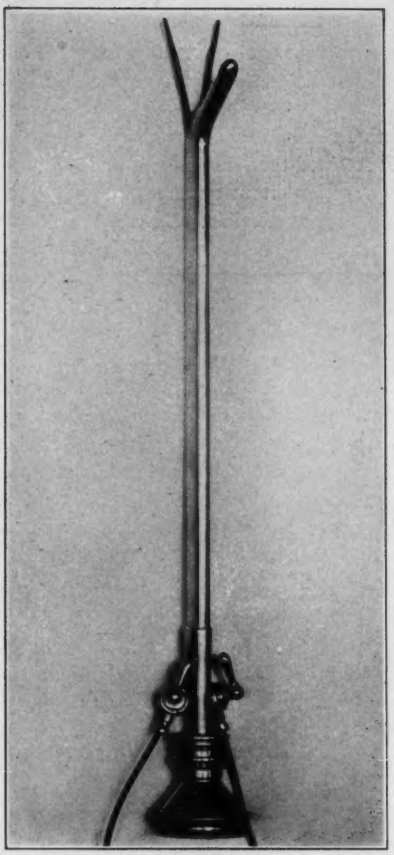

FIG. 1.

FIG 1*a*.

FIG. 1*a*.—Beak (much enlarged) of this Brown-Leiter double-catheter cystoscope, showing in order from above: Metal screw-cap enclosing changeable electric high voltage lamp behind a curved rock crystal window in the hood. Vesical or terminal lens of the telescope is seen through another underlying oval glass window, and below this two ureter catheters protruding.

FIG. 1.—The F. Tilden Brown original and first-ever double-catheter direct-vision cystoscope, made in 1898, by Joseph Leiter and Son, of Vienna. Shaft ovoid. Length of applicable part 15 centimetres, circumference 25 5 millimetres.

# PRESENTATION OF A NEW MODEL OF THE AUTHOR'S COMPOSITE (DOUBLE CATHETERIZING) CYSTOSCOPE[1]

By F. TILDEN BROWN, M. D., of New York

ON May 1, 1900, in a paper read here in Washington, before this Association[2] by invitation of our then President, Dr. James Bell of Montreal, entitled: "What is the Best Method for Obtaining Urines Direct from the Ureters for Diagnostic Purposes," I had the honor of presenting,—so far as my search then and since enables me to know anything to the contrary,—the first double catheter cystoscope (Figs. 1, 1*a*) ever made and successfully employed. While this was but a modification of Brenner's (Figs. 2, 2*a*), useful but much decried[3] single catheter cystoscope, wherein my addition of the second catheter canal to an instrument retaining the general features of the Brenner, was at once impressive enough, both by reason of the comparative ease of synchronous catheterization, and particularly by the much more reliable diagnostic data obtained, to warrant the author's statement at its then presentation with these advantages "convinced me that in the future any device which does not provide for such synchronous collection, as a routine measure, must be considered antiquated." Within the following two years both Nitze and Casper had changed their cystoscopes from single to double catheter instruments.

This oval-shaft double-catheter cystoscope (Figs. 1, 1*a*) was made by Leiter, of Vienna, according to drawings and written specifications, which were translated into German and transmitted for me by Messrs. Tiemann and Company, of New York, more than two years before the Washington presentation, and this same cystoscope had been already shown before the New

[1] Presented at the second day's meeting.

[2] American Association of Genito-Urinary Surgeons, Fourteenth Annual Meeting, Washington, D. C., May 1, 2 and 3, 1900, published in the Journal of Cutaneous and Genito-Urinary Diseases, Vol. XVIII, p. 409, 1900.

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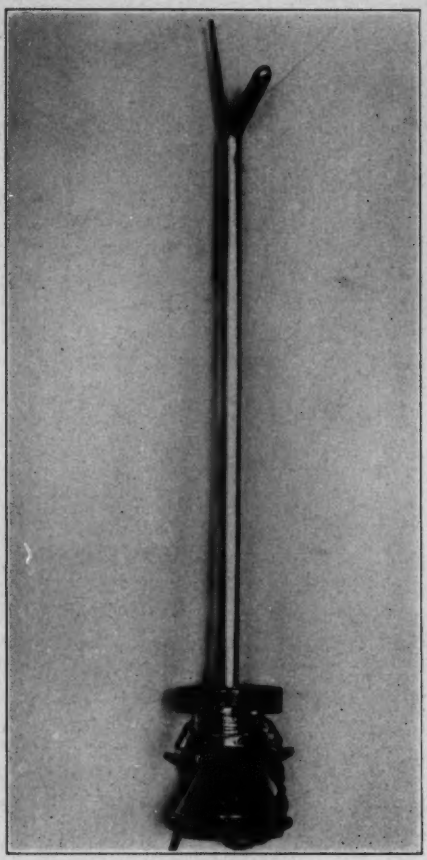

FIG. 2.

FIG. 2*a*.

FIG. 2*a*.—Beak (much enlarged) of the Brenner single catheter cystoscope, showing in series metal screw-cap, having a rock crystal window in front of a changeable high voltage electric lamp. Vesical or terminal lens of the telescope is seen through another oval glass window cemented in the metal,—a single catheter protruding.

FIG. 2.—Dr. Brenner's original and first-ever single catheter direct-vision cystoscope, made in 1889, by Leiter and Son, of Vienna. Shaft ovoid; length 15 centimetres, circumference 23 millimetres.

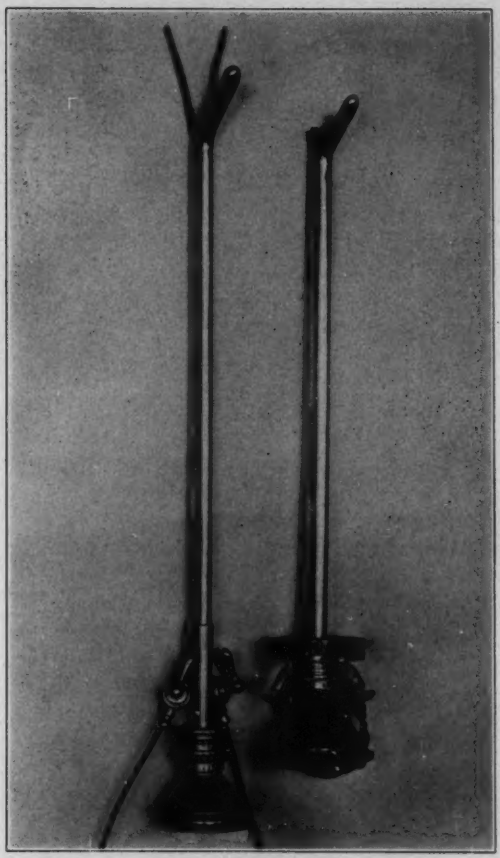

FIG 2*b*.

FIG. 2*b*.—The Brenner and Brown direct-vision single and double catheter cystoscopes.

York Surgical Society, in connection with the author's paper: "The Differentiation of the Urines" (*Annals of Surgery*, Vol. xxx, p. 661, 1899), wherein some fifty-six cases of ureter catheterization were reported, and the comparative advantages and the reverse of the then existing catheterizing cystoscopes, used in this series of cases, were made the subject of critical analysis from the author's experience with them. In general, his findings were in favor of the direct-view cystoscope of Brenner, in contrast with the prismatic or indirect-vision instruments of Nitze, Casper and Albarran.

This decision was not based on the optical properties of the Brenner, because in these respects the advantages were rather with the former authors, so much as it was on the total of other favorable features, such as ease of introduction, freedom from danger of burning, easy control of the catheter, avoidance of leakage, ease of cleansing, etc. And from the results of these comparative tests and from a final better appreciation of the short-comings of each, sprang the incentive to make an instrument which would provide improved irrigation facilities, and, if possible, one to effect, in favorable cases, synchronous catheterization of the ureters. As already said, in simple conditions, this first double catheter cystoscope (Figs. 1, 1*a*) was a greater success than I had dared to hope for, but, in difficult cases, mainly those where the distending medium was quickly rendered turbid by pus or blood admixture, this new Brown-Leiter instrument with canals for two catheters, could not well be employed for synchronous catheterization, since one catheter only could here generally be used, as the remaining catheter-canal was needed to effect repeated irrigation and evacuation until the medium was rendered clear enough to see to utilize a single catheter. Consequently, it was clearly demonstrated that to catheterize both ureters at the same time, in these trying cases, there was need of some better instrument than this two catheter improvement upon the single catheter Brenner; in other words, an instrument was required which, while providing for two catheters, was also equipped with generous water-ways for quick irrigation. To effect this in my modification of Brenner's cystoscope, or in any of the existing prismatic catheterizing cystoscopes, was not feasible without adding so greatly to the circumference

of these instruments, that urethral introduction would, in the majority of patients, be impossible. Like all pre-existing and contemporaneous cystoscopes, of the direct-vision type, my Leiter-made instrument had a glass window (Figs. 1*a*, 2*a*) at the vesical end of the tube, countersunk for smoothness' sake, in the metallic margin of the shaft, and it was the waste room required for the water-tight setting of this window, as well as the window itself, which, as already stated, made it impossible to gain the space required, and not, at the same time, increase the shaft to an impossible size. So that by doing away with this heretofore supposedly necessary window, and employing an open tubular sheath for various kinds of lens-exposed telescopes, was to constitute the first departure in a new type of examining and double-catheterizing crystoscope, devised and made by the writer and Mr. Reinhold Wappler, of New York City. (Figs. 3, 3*a*, 3*b*.) In this windowless instrument, of 25 Charriere measurement, was now found space for a telescope, two catheter tubes, and two independent conduits (see arrow in Figs. 3*a*, 3*b*) for bladder irrigation and evacuation. Nearly simultaneous additions were the other interchangeable telescopes (Fig. 3*c*) for examining purposes where the indirect-vision telescopes, right angle and varying degree of retrograde-vision, extended nearly an inch (Fig. 4*b*) beyond the heel of the sheath, so as to take advantage by propinquity of the brightest rays from the lamp, and, in this way, greatly improve the visual field. Besides, this indirect-vision telescope could be turned independently of the sheath so as to view the bladder-wall on either side of the beak-bearing lamp. Or again, by keeping the open electric lamp in a small part of the center of the lens of this protruded telescope, the lamp itself could be watched while used as a cold probe to move and deflect intravesical bodies, and, in this way, determine whether such were lime-encrusted pedunculated tumors, or stones, or what not. These several different telescopes (Fig. 3*c*), for the same sheath, at once, in 1901, suggested the name, "Composite Cystoscope," by which the instrument has been known ever since. A little later it was seen, by extending the direct-vision telescopes also, both catheterizing and examining, so as to protrude a quarter inch more or less beyond the convexity of the sheath (Figs. 3*a*, 3*b*, and 5), and so bring

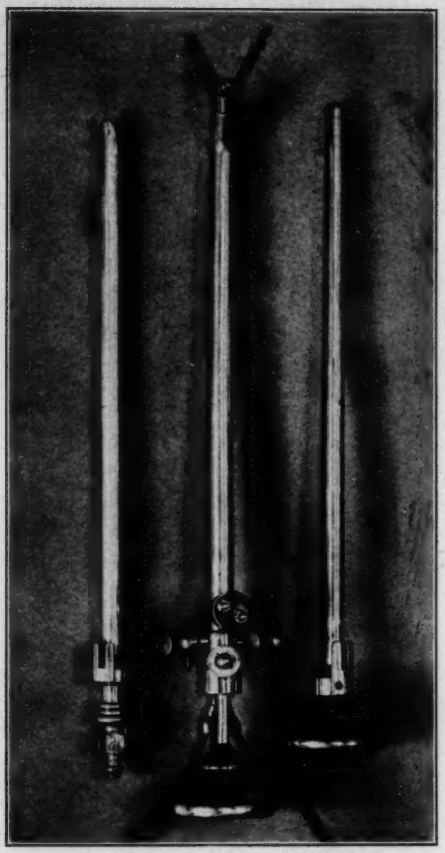

FIG. 3.

FIG. 3.—The F. Tilden Brown original composite cystoscope, made in 1901, by Reinhold Wappler of New York. Cylindrical sheath (applicable length) 14.5 centimetres, circumference 25 millimetres.

Features: 1st, An open sheath by omission of the then customary terminal window. 2nd, Different interchangeable telescopes. 3d, Rapid and free irrigation through the sheath with or without the telescope in place. 4th, Cold lamp. 5th, Still unique in the employment of a double catheter telescope. 6th, Unique also in the adoption of a beyond-the-lamp position for the vesical lens of the indirect vision and retrograde telescopes.

FIG. 3*a*.

FIG. 3*a*.—Beak (much enlarged) of a composite cystoscope with the double-catheter telescope protruding from the sheath. The changeable electric lamp (cold) is inclosed in a glass cap, over which the usual metal hood is omitted, in order that the various telescopes can find their different visual fields equally illuminated. The arrow points to one of the lateral irrigating or evacuating canals afforded by a triangular waste space between the inside of the sheath as base, and the outer surface of the telescope and catheter tube.

FIG. 3*b*.

FIG. 3*b*.—Beak (much enlarged) of an oval sheath composite cystoscope showing the telescopic tube attached to a single much larger one, serviceable as the conduit for a very large ureter catheter, or a tube of radium or such instruments as forceps and scissors.

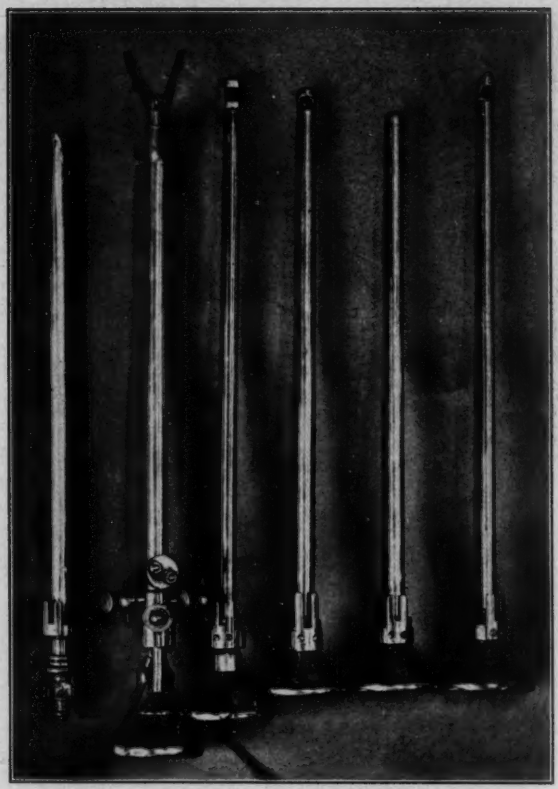

FIG. 3c.

FIG. 3c.—The same original composite cystoscope with additional retrograde telescopes.

the lenses of either of these telescopes closer to the lamp, that their visual properties were in the same way very materially improved, and rendered superior to the direct-vision cystoscope of European make. And it seems to the author as most probable that it was due to a failure on the part of such makers to experiment with these protruding telescopes, that the continental masters in cystoscopy and their students have ever since remained conservatively imbued with the notion that, whether for examination or catheterization, the prismatic or indirect-vision cystoscope was the only one of account. It is gratifying to the author to note that in America, at least, there is a rapidly-growing sentiment in favor of the direct-vision telescope for purposes where the European cystoscopists would seldom think of utilizing it.

This second instrument of the author's (Figs. 3, 3*c*), for general examinations and synchronous catheterization of the ureters, was shown before the New York Surgical Society, on January 8, 1902, and under the title: "A Composite Cystoscope for Bilateral-Ureter Catheterizations and Examinations," it was reported, with illustrations, in the *Annals of Surgery*, 1902, Vol. xxv, pp. 642, 643. In this report, in the *Annals of Surgery*, reference is made to a somewhat earlier article of the author's, describing the instrument, entitled: "Technique of Ureter Catheterization," which should have been printed, "Two Papers Relating to Ureter Catheterization," published with numerous illustrations in the *Medical and Surgical Report of the Presbyterian Hospital*, January, 1902, Vol. v, pp. 70 to 98, inclusive.

The next change in one important detail of the composite cystoscope, is seen in Figs. 4, 4*a*, 4*b*, 4*c* and 16, where the double fenestration is shown as first employed (1903). This second fenestration is in the concavity at the foot of the beak and intended to facilitate use of the prismatic or any of the different grades of indirect-vision telescopes in that the latter could have their terminal lens set proximal to the lamp and to look through this opening (Fig. 4*a*), or the same telescopic tube could be shoved further through the sheath so as to have its terminal lens protrude well beyond the other and original fenestration at the heel or convexity (Fig. 4*b*). By this particular adjustable telescope, in the doubly-fenestrated sheath, we were easily able to contrast

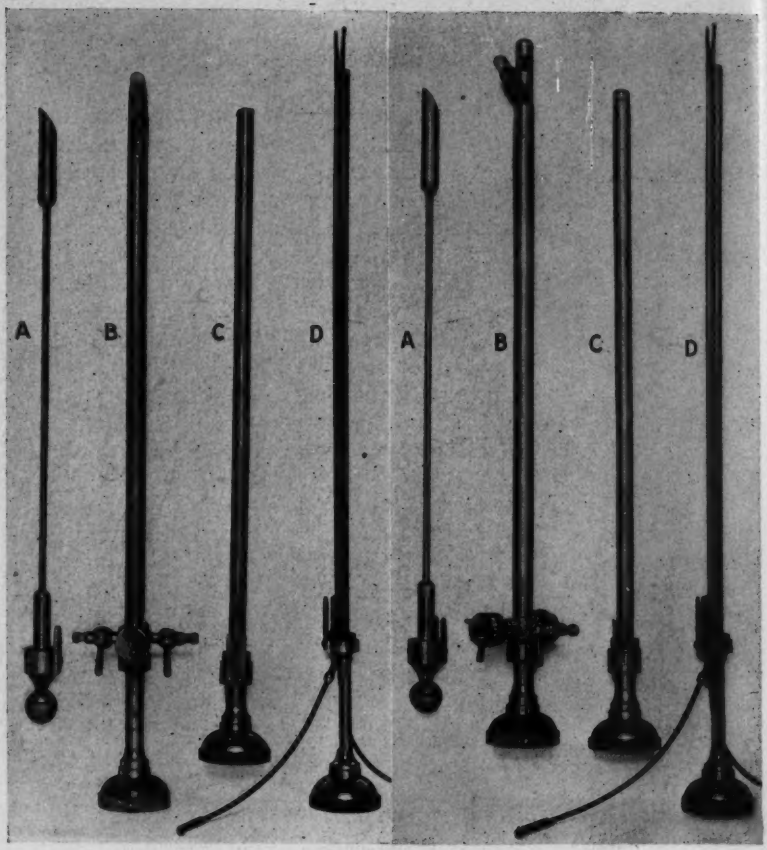


FIG. 4.

FIG. 4.—The F. Tilden Brown second design (red-and-blue ring pattern) of the composite cystoscope (1903, Wappler, maker).

Sheath cylindrical, length 20 centimetres, circumference 26.5 millimetres.

Besides the original heel fenestration, this design was the first to employ a second opening at the concavity to permit the use of the same long prismatic telescope through this opening, as well as through that at the convexity when pushed further into the sheath. In this way, the same telescope was advantageously used either distally or proximally to the electric lamp. This fenestration in the concavity was also designed to serve as an outlet for ureter catheters under the control of an indirect-vision telescope. The original fenestration at the convexity, as in other forms of the composite cystoscope, employs the direct-vision catheterizing telescope.

FIG. 4*a*.

FIG. 4*a*.—Beak (enlarged) of a red-and-blue ring pattern composite cystoscope, showing lens of the right angle or retrograde telescope, as used in the concavity fenestration, proximal to the lamp.

FIG. 4*b*.

FIG. 4*b*.—Beak (enlarged) of a red-and-blue ring pattern composite cystoscope, showing lens of the same indirect-vision telescope, shoved forward in the sheath well beyond the convexity fenestration, when employed distal to the lamp.

FIG. 4*c*.

FIG. 4*c*.—Beak (enlarged) of the red-and-blue ring pattern composite cystoscope, to show the relatively (in comparison with other catheterizing cystoscopes) even surfaces of the two fenestrations when filled by the obturator.

the relative advantages of the almost-universally-employed-in-Europe prism lens at the concavity with our Otis' hemispherical lens at the same concavity fenestration or at that in the convexity with the same telescope pushed well beyond the sheath and into a better illuminated area.

This model of the composite cystoscope was not put on the market owing to a lack of structural strength. The beak had so little metal support as to endanger it, and the electric light connection, on the slightest fall. Some experimenting was done with this model to perfect an indirect-vision double-catheter telescope to operate through the fenestration in the concavity, and as supplemental to the direct-vision double-catheter telescope which operated through the opening or fenestration at the heel, as in all its predecessors, of the composite type. Personally, the need of this additional indirect-vision catheterizing telescope was not felt but, as already stated, the student trained in European cystoscopy, believed it was the only form to use, and it was to meet such demand that the effort was undertaken but only completed in January, 1908, in the inverted lamp model, red, white and blue pattern (Figs. 14, 14*a*, 14*b*, 14*c*).

The exposed lamp in the composite cystoscope has never given me any concern. Its hoodless state was necessary in order to light all arcs of the bladder, and so meet every requirement of the different interchangeable telescopes. The composite cystoscope, and at this time practically all genito-urinary instruments of American make, dependent upon electric illumination, were in turn much helped by adopting some form or another of the discovery of W. C. Preston, of Rochester, N. Y., in his practically heatless "cold lamp." While to Dr. Henry Koch,[1] also of Rochester, is due the credit of its first practical adaptation to urethral instruments, in the mignon size, as instanced in the Swinburne urethroscope, then and since made by Dr. Koch's original firm, the Electro Surgical Instrument Company. The evolution and varying patterns of the composite cystoscope, up to the present time, were pretty fully described and illustrated in an article published in the *Medical and Surgical Report of*

[1] To our fellow member, Dr. E. Wood Ruggles, of Rochester, as to whose disinterested accuracy there can be no question, I am indebted for these statements regarding the origin and early history of the "cold lamp."

FIG. 5.

FIG. 5.—Lateral view of the composite cystoscope (blue ring pattern). Oval sheath, length 16.5 centimetres, circumference 26 millimetres, with a double catheter telescope in the sheath showing the approximate protrusion of the vesical lens beyond the end of the sheath, in order to bring it near enough to the lamp to take advantage of the best part of the illuminated field. A pair of screw-neck vials are shown suspended in the yoke, each holding a ureter catheter during urine collection.

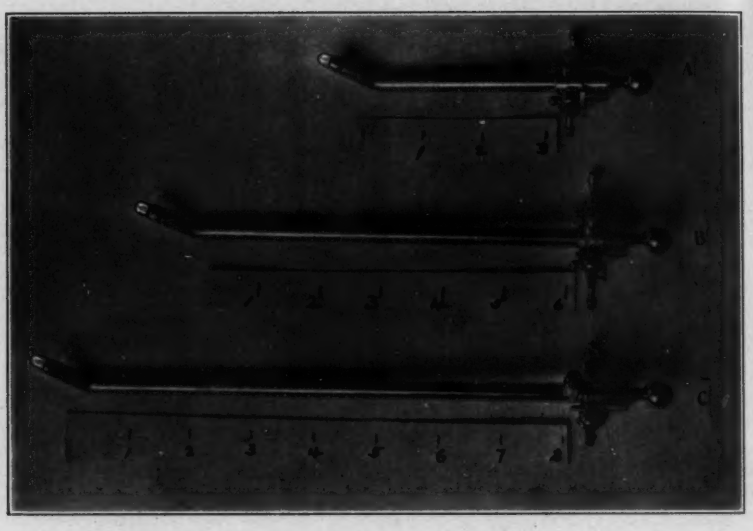

FIG. 6.

FIG. 6.—Three obturated cylindrical sheaths of as many composite cystoscopes, of varying lengths, among the earlier patterns.

A. 7.5 centimetre sheath, exclusively for the female urethra.

B. The 16-centimetre sheath, equally adaptable for the average male and female case.

C. The 20-centimetre sheath, a specially-made long instrument for unusual male cases.

*Bellevue Hospital*, New York, Vol. i, Jan., 1905, and entitled: "A Demonstration of Synchronous Ureter-Catheterization in a Male."

Within the last year or so I have had Mr. Wappler apply to the composite cystoscope another device, which this same Electro-Surgical Instrument Company appears to have had priority in employing, namely, the inverted lamp—as first seen in their own instrument, and later in those made by this company for Drs. Belfield and Elsner. None of their various cystoscopes were then, however, of the type employing telescopic tubes. Although these instances represent the earliest uses or applications I can find recorded of the inverted cold lamp, it is to be remembered, in regard to this inversion, that Nitze, in his first cystoscope, and before the introduction of the Edison glass incandescent lamp, gave the minute light-producing resistance coil just the same inversion and relative position.

The present and latest model of the composite cystoscope, now shown (Figs. 7, 7*a*), has as its novel features the restored double fenestration for telescopic tubes which here do not need to protrude beyond the convexity because of this change in the lamp's position, where, instead of being at the top of the beak, is, by inversion, at the bottom; and, consequently, in close and equally good apposition to the terminal lens of both the direct and the indirect vision telescopes. This position of the lamp is a more favorable one for the efficiency of an unprotruding telescope than was the case in my earlier model (Fig. 4*a*), where the lamp was upright and set at the top of the beak. It is yet to be determined whether this newest model (Fig. 7), will give better, or as good results as its immediate predecessors (Figs. 3, 4). Certainly, it is fair to fear that the lamp, being much smaller, will have a shorter life. The optical parts, however, and the illumination are excellent, and by reason of nonprotruding telescopic tubes and some minor changes of cocks, etc., the whole appearance of the instrument is improved. In its present form, in the hands of a novice, there is also less chance of doing injury than with the former model where, if hasty removal of the whole were attempted, without attention being first given to withdrawal of the projecting telescope, harm could easily result.

The trocar and canula supra-pubic composite cystoscope is shown in (Fig. 8) which for economic purposes utilized the tele-

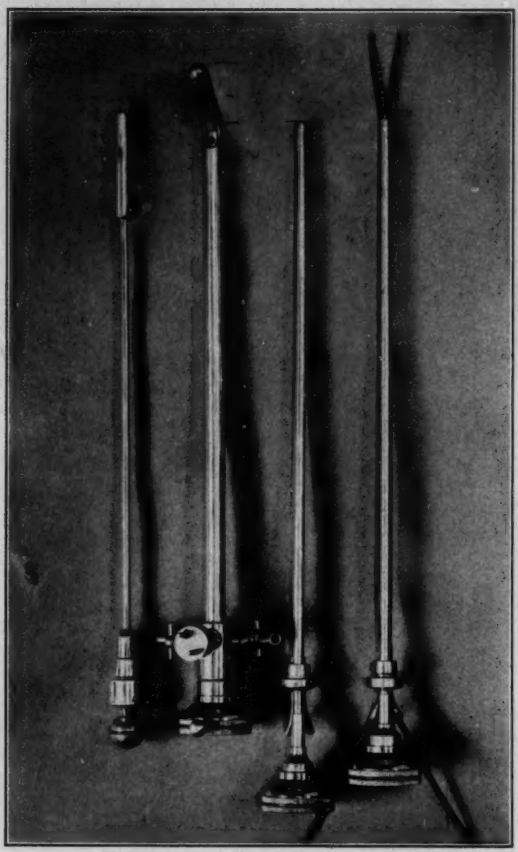

FIG. 7.

FIG. 7.—The F. Tilden Brown composite cystoscope (third design, red ring pattern), oval or cylindrical sheath; length 18 centimetres, circumference 25 millimetres, having two fenestrations and an inverted cold lamp; also non-protruding interchangeable telescopic tubes. The indirect-vision telescope is shown occupying the sheath and its hemispheric lens looking out of the concavity fenestration. Inversion of the lamp brings it in this pattern so much closer to the terminal lens of the different telescopes that no protrusion of the latter is necessary.

FIG. 7*a*.

FIG. 7*a*.—Beak (enlarged) of the composite cystoscope (red ring pattern) showing in series, 1st, The changeable inverted cold lamp within its metal capped glass socket; 2nd, The uncovered vesical (terminal) lens of the direct vision double-catheter telescope; 3rd, Two ureter catheters protruding from their separate canals.

scopic tubes belonging to the earliest set known as the black ring pattern. On withdrawing the trocar after puncture, the long stem "cold" lamp is passed so as to protrude at the vesical periphery; then any of the telescopes follow and all are bound in place as a whole by the thumb screw at base of the canula.

The different sized and shaped sheaths of the various composite cystoscope patterns are shown in Fig. 9, dating from 1901 to 1907.

Since in the last three or four years about as many cystoscopists have by reason of an insignificant change of form made by them in some detail of the composite cystoscope, especially in the canals of the catheter telescope (Fig. 10), appeared to feel themselves justified in presenting the entire instrument as their own, it may be of interest to see if, and if so, how soon, this latest model will receive similar attentions.

For such a sentiment as well as for the monotonous detail and egoism accentuating this record of origin and developmental history of the composite cystoscope, the writer begs to apologize, at the same time making manifest the purpose to record his claim for authorship in its essentially novel and practical features. And at the same time to contend that an imitator is not justified in giving his name exclusively to any result, so long as the remaining features of the original continue to constitute the major value of the entire device. On the other hand if the alteration, whether an addition or omission, is one of such commanding importance as to overshadow the original in the estimation of those using such tools, the change in name will naturally follow, and such instrument will shortly be known by a new and deserving title.

I have taken advantage of the delay in publishing these *Transactions*, to include the presentation of several devices, not shown at the Washington meeting.

One such is a shorter coupling for the beak and staff of the cystoscope as shown here attached to the Wm. K. Otis examining cystoscope and described in Fig. 11.

Another, these inch-marked catheters and perineal drainage tubes (Fig. 12) as made by Messrs. Johnson and Johnson, of New Brunswick, New Jersey.

Also two forms of harpoon retractors for hasty suprapubic cystotomy (Fig. 13).

I wish to include in this list as well, two new double-catheterizing telescopes for the composite cystoscope (Figs. 14, 14*a*, 14*b*, 14*c*), one being a hemispherical lens telescope for right-angle-vision and looking through the fenestration in the concavity (Fig. 14*b*); the other and last completed attachment of the composite cystoscope being an oblique-vision lens telescope (Fig. 14O) where the divergence of rays is in the arc of from 10° to 85° looking through the opening at the convexity as with

(*Concluded on page 399.*)

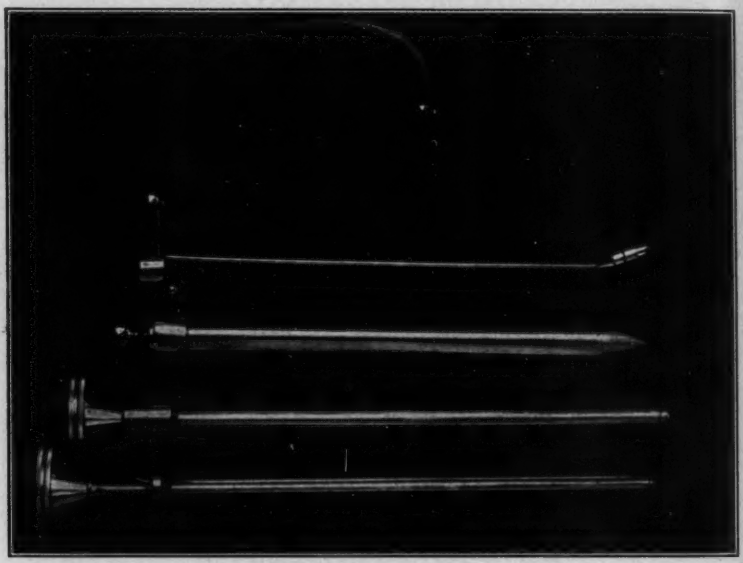

FIG. 8.

FIG. 8.—The F. Tilden Brown composite suprapubic cystoscope. Ovoid sheath, length 15.5 centimetres, circumference 28 millimetres. The ovoid canula is shown with trocar in place; on the latter's withdrawal the long-stem angled-cold-lamp is pushed through the canula, and then any of the telescopic tubes belonging to the single black-ring pattern instrument can be employed as successfully as by way of the urethra.

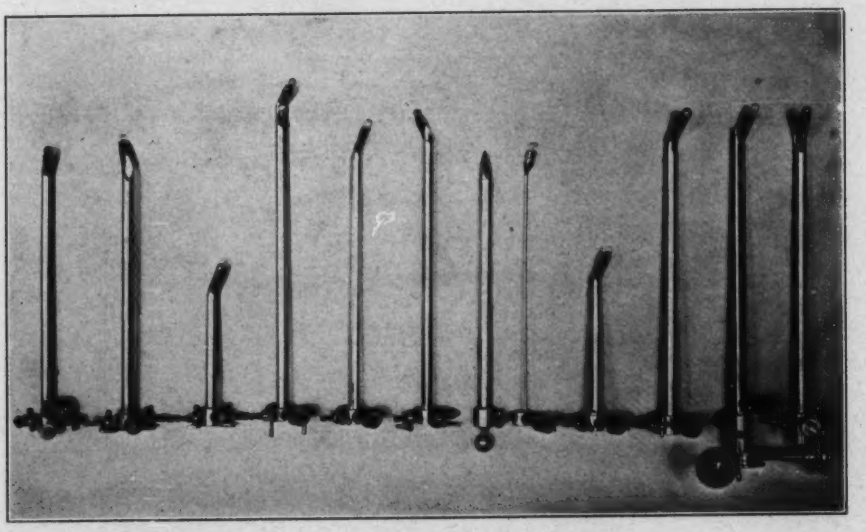

FIG. 9.

FIG. 9.—Assemblage of various cold-lamp-lighted-sheaths, belonging to the author's series of composite cystoscopes.

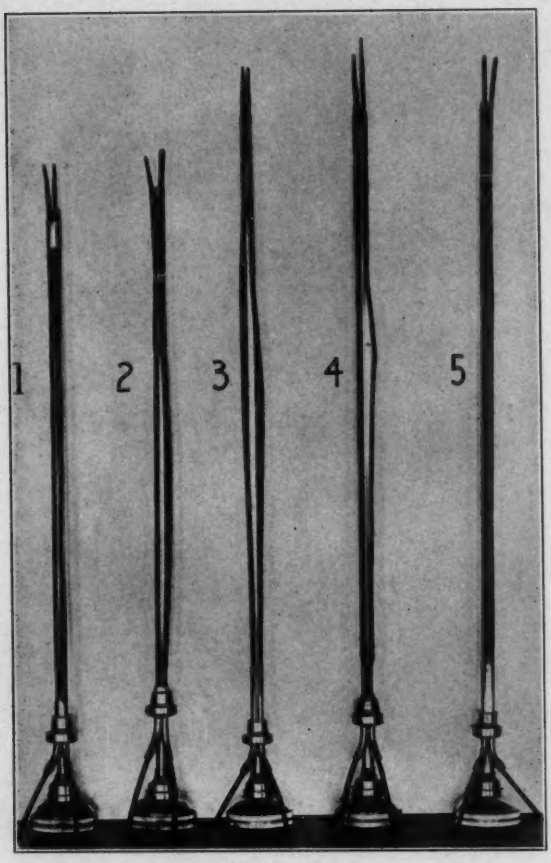


FIG. 10.

FIG. 10.—To illustrate the insignificant detail on which three claimants for authorship of the "composite cystoscope" base their assumption.

The double catheter telescopes most used by the author are Nos. 1 and 2 and of this shorter length.

No. 1.—A telescope for two catheters with a short tunnel at base and tip, having a septum between the catheters.

No. 2.—A telescope for two catheters, having no supporting tunnel at the tip, but a separating longitudinal fin. Useful when larger catheters need to be used. Similar to No. 4 except shorter.

No. 3.—A telescope for two catheters, having a short tunnel at base and tip, but with no septum at the tip between the catheters—useful for spring catch forceps.

No. 4.—A telescope for two catheters with a longitudinal fin only separating them. Useful when larger catheters are necessary. Similar to No. 2 except in length of telescopes.

No. 5.—A telescope for two catheters having an open half-cylindrical groove partly separating and partly supporting each catheter.

FIG. 11.

FIG. 11.—F. Tilden Brown's shorter elbow to connect shaft and beak; applicable to any form of indirect-vision (prism or hemispherical lens) cystoscope where it secures a closer approximation of lamp and lens than heretofore; hence better visual properties. (L.B.) Detail of lamp beak. (S.) Sheath with short lamp beak attached. (P.T.) hemispheric lens telescope. (See also Fig. 20.)

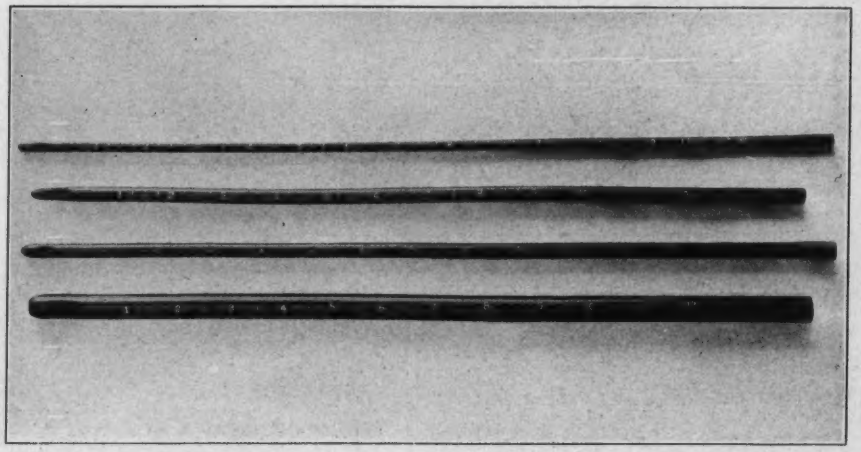

FIG. 12.

FIG. 12.—The author's inch marked catheters and perineal tubes. For an easier, cleaner, and more accurate method of estimating the "Urinary Distance" (Keyes) also for a safer introduction to "Catheter Life." These markings applied to perineal tubes should obviate in great part the annoyingly frequent failure of such bladder drainage, due in most cases to the tube being in too far and its eyes buried in collapsed bladder wall, or, on the other hand, out so far as to be in the prostatic or membranous urethra.

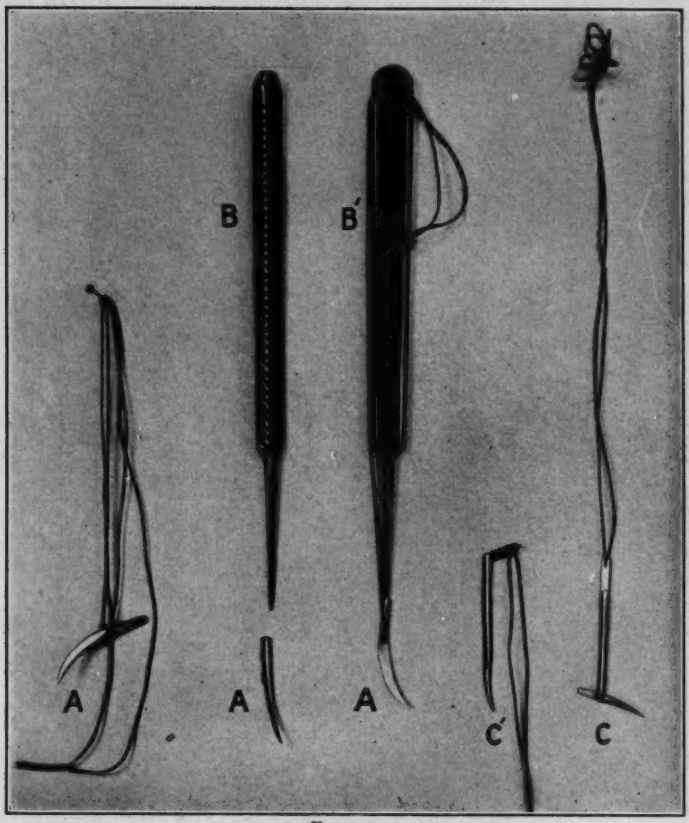


FIG. 13.

FIG. 13.—The author's harpoon retractors for hasty epicystotomy. A. Curved needles with eye near centre; so balanced as to keep the point turned downwards.

The handle for these needles (B, B′) has its point socket into the needle loosely so that on withdrawal after puncturing the distended bladder, the needle drops off within and turns transversely.

(C, C′) A pair of vesical harpoon retractors in which the position of needle in relation to the shaft is governed by the silk-carrying lever at upper end of the shaft. Puncturing the bladder wall with harpoon held between thumb and finger; the lever is then turned up in line with shaft, which turns the needle to a transverse position.

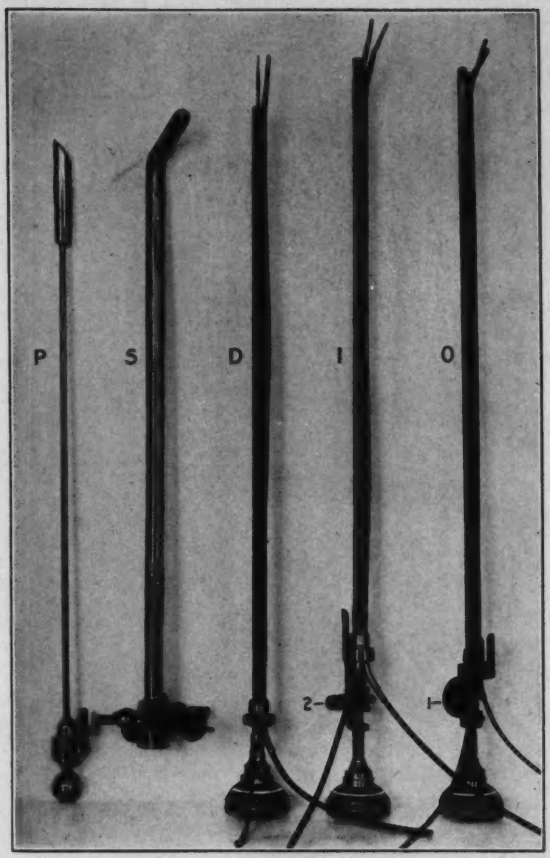


FIG. 14.

FIG. 14.—The author's red, white and blue ring pattern composite cystoscope, 1908.

(D) Direct vision double catheter telescope.

(I) Indirect vision (hemispherical lens) double catheter telescope, operable through opening in concavity. (2) Lever control of catheter.

(O) Oblique vision double catheter telescope, operable through opening in convexity. (1) Eccentric lever control for deflecting the catheter tips.

(S) Sheath with a fenestration at concavity and convexity.

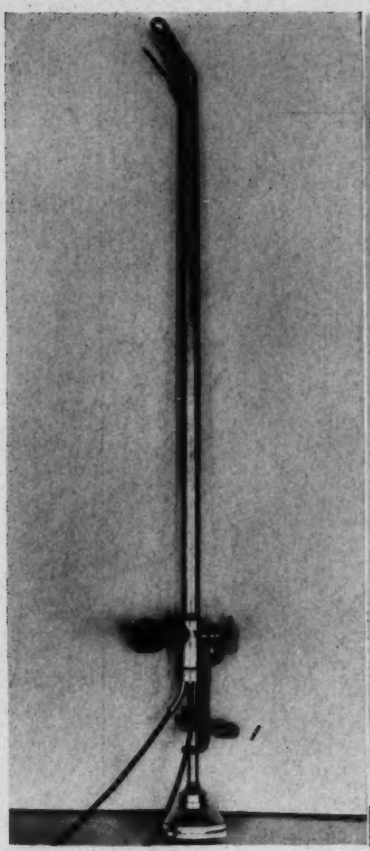


FIG 14*a*.

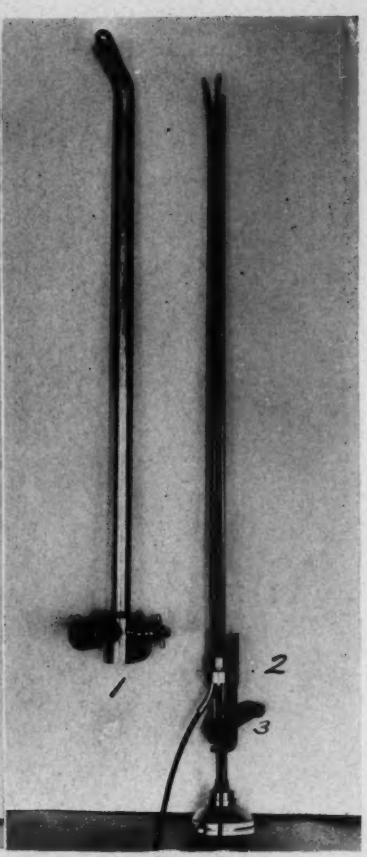


FIG. 14*b*.

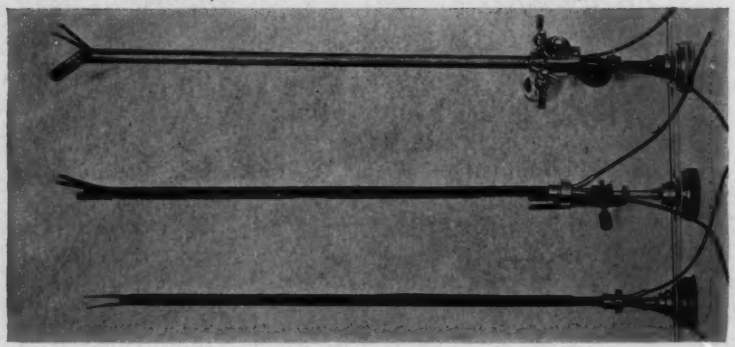

FIG. 14*c*.

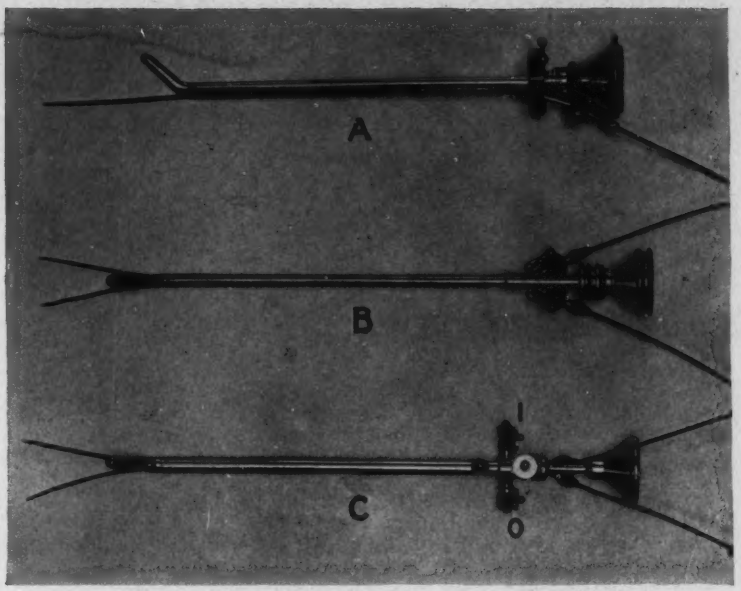


FIG. 15.

FIG. 15.—Brenner-Leiter, Brown-Leiter, and Brown-Wappler ureter-cystoscopes.

(A) BRENNER. The first ever single-ureter catheter cystoscope, with direct vision telescope looking through a glass window at the convexity. Made by Leiter of Vienna, 1887. Length of available ovoid staff, six inches = 15 c. m. Circumference, 23 m., using a hooded electric (Edison) changeable lamp—hot.

(B) F. TILDEN BROWN. The first ever double-ureter-catheter cystoscope, with direct vision telescope looking through a glass window at the convexity. Made by Leiter of Vienna, 1898. Length of available ovoid staff, six inches = 15 c. m. Circumference, 25.5 m. Using a hooded, electric (Edison) changeable lamp—hot.

(C) F. TILDEN BROWN. The original composite cystoscope, having an open sheath without glass window, into which were insertable a direct vision, double-ureter catheter telescope, a direct vision examining telescope, an indirect vision (prism) examining telescope and later examining telescopes of varying degrees of indirect vision (different approximations of the spherical lens). In addition provision for independent water conduits was made (I and O, Fig. C.) Made by Reinhold Wappler of New York, 1901. Length of available cylindrical staff, five and a half inches = 14 c. m. Circumference 25 m. Glass-enclosed "cold" lamp (Preston-Koch)—wholly exposed.

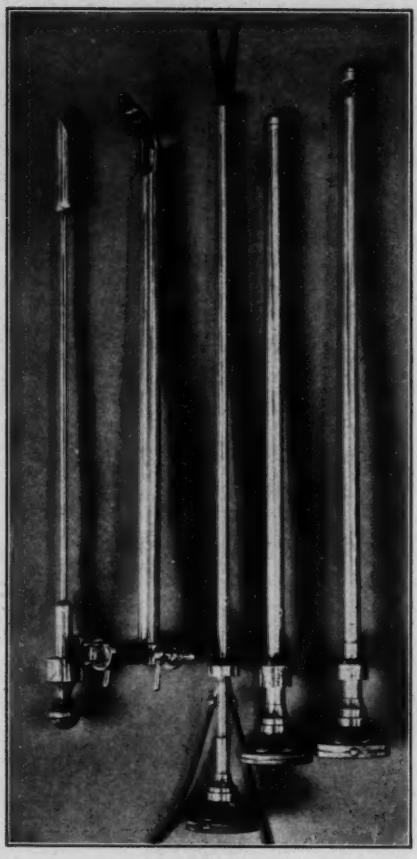

FIG. 16.

FIG. 16.—The author's first composite cystoscope with double fenestration, 1903.

the first direct-vision telescopes. In this new telescope with deflected light rays, a lever mechanism is introduced for deflecting the catheters also (Fig. 140). The great advantage of this deflecting catheterizing telescope over the right-angled vision one lies in the fact that if it is desired to remove the cystoscope while leaving the catheters in place, it can be accomplished without the customary annoyance of having to turn the cystoscope completely around, and then, except in Dr. Bierhoff's excellent cystoscope, having the catheters crossed.

## PRESENTATION OF APPLIANCES TO FACILITATE MAJOR GENITO-URINARY OPERATIONS AND EXAMINATIONS, ESPECIALLY AT THE PATIENT'S HOME[1]

By F. Tilden Brown, M. D., of New York

### THE HINGED PROP IN SURGERY

THE successful accomplishment of many operations and examinations of the urinary tract is dependent on a proper posturing of the patient. The easy performance of a lumbar nephrectomy, for instance, often depends on the fullest extension of the ilio-costal space. Air cushions and sand bags under the opposite side are still more or less employed to effect this exposure, but we all know their many faults and inconveniences. About 1895 I offered a double-inclined hard mattress as substitute, but this was soon discarded as too cumbersome except for hospital use. Our fellow member, Dr. Cunningham, has perfected an admirable device for the purpose, in the shape of a horizontal metal bar, counter-sunk in a two-inch groove, extending across the middle of the table, which can be raised and lowered at ease by crank and ratchet. This bar besides has a series of sockets for two movable posts, which help to keep the patient from rolling backward or faceward.

[1] Presented at the first day's meeting.

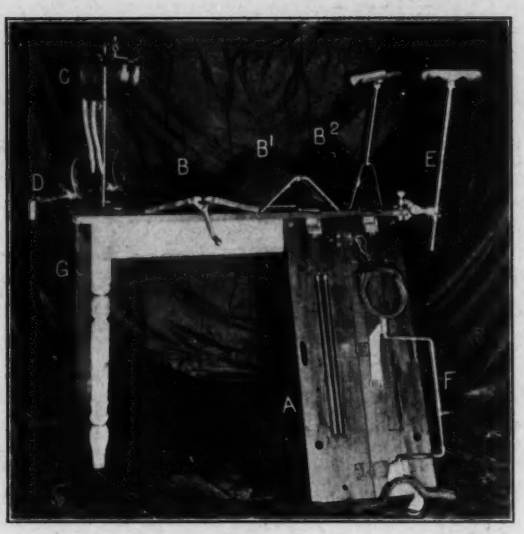


FIG. 17.

FIG. 17*a*.

FIG. 17.—Assemblage of portable appliances for Genito-Urinary operations and examinations:

(A) Folding long-board.

(B) Kidney-and-liver-props of different materials, and shown in different degrees of angling.

($B^1$) Wooden kidney-liver-prop, shown nearly flat, with the controlling crank attached.

($B^2$) A similar aluminum prop partly raised.

($B^3$) Sheet steel kidney-liver-prop, angled to full height.

(C) Extension arm-gallows, with adjustable straps,—one for above and one below the elbow.

(D) Clark and Roberts neck-yoke. Adjustable to any table. Some contrivance of this sort is demanded in perineal prostatectomy, and operations where similar degrees of body inclination are necessary, in order to prevent the patient receding from the end of the table.

(E) Portable leg-rests adjustable by serrated clamps, having three planes of motion and control, similar to those attached to the author's cystoscopic X-ray table.

(F) The author's modification of Clover's crutch; where the connecting bar is angled so as to be out of the way during introduction and withdrawal of urethral instruments, and lying in a better position for the hand control of an assistant.

(G) A small household pine table, 3′ 6″ in length. Large and strong enough for any of these operations and examinations when kept on its four legs.

FIG. 17*a*.—The author's hinged kidney-and-liver-prop and the adjustable arm-gallows for favoring respiration and maintaining the patient's balance, when side postured for kidney operations.

FIG. 18.

FIG. 18.—Individual on the author's X-ray cystoscopic table. Postured (anterior view) for lumbo-abdominal operation on the kidney. The kidney-and-liver-prop is seen under the opposite side. The arm-gallows lifting shoulder and arm from the right half of the thorax serves the double purpose of removing weight and thus assisting respiration, as well as serving to prevent the patient rotating forward on the table. This stability of posture is maintained the better by a modified Syms position of the legs, and adhesive plaster fixation to the table across the pelvis.

FIG. 18*a*.—Back view of the same. Individual postured for lateral or lumbo-abdominal exposure of the right kidney. Adhesive plaster anchorage to the table is here too loose. The practice of using a similar strap over the thorax or shoulder needs only mention to be condemned as enhancing the difficult respiration invited by other features connected with this posture. The support given by the arm-gallows is a perfect substitute for any such use of adhesive plaster over the shoulder.

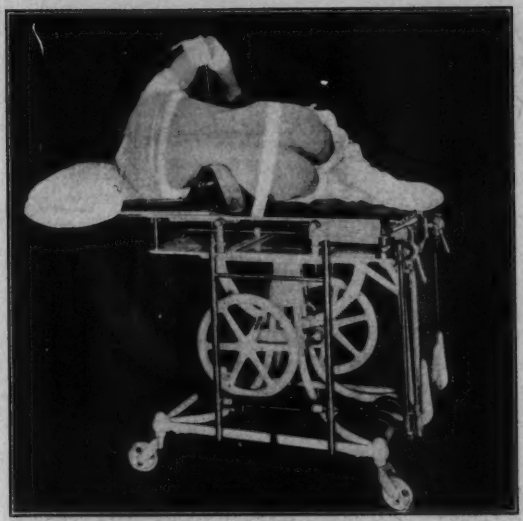

FIG 18*a*.

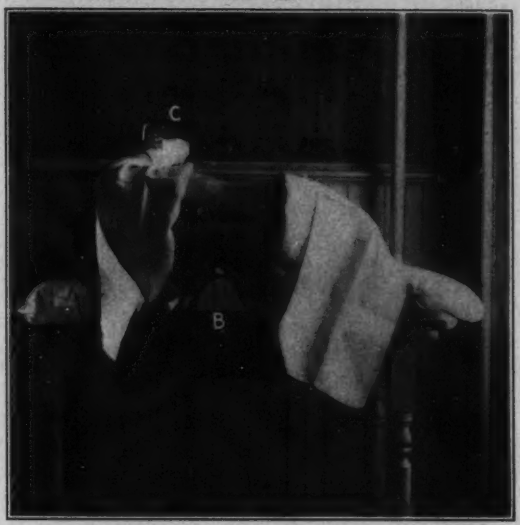


FIG. 18*b*.

FIG. 18*b*.—The author's kidney-liver prop and arm-gallows in use with patient postured on short ironing table.

This controllable bar is an essential part of the table, and, consequently, not portable. The substitute here offered is a folding board (Figs. 17, 17*a*), or when made entirely of metal, as in this pattern, it closely resembles a huge hinge, adaptable to the required height by changes in its degree of angling, accomplished by crank on a self-holding screw.[1] Its portability and adaptation to an operating (Figs. 12, 12*a*) or household table make for its utility. It is also found to be useful under the dorsal spine, to expose the organs in the upper quadrants of the abdomen; or again, when covered with a thicker and a firmer cushion, to elevate under the abdomen, in spinal or synchronous kidney operations. The ability to easily increase or lessen (Fig. 11*a*) the angle of the hinge, and, consequently, the degree of surgical exposure, at any stage of the operation, is of value.

### THE ARM GALLOWS (Figs. 17C, 17*a*, C)

In association with this surgical prop (Figs. 17B, 17*a*, B) when used for lateral exposure of the kidney, the so-called "arm-gallows" is of double service:

First, in helping the patient to breathe safely and easily during anæsthesia, and,

Secondly, in serving as an anterior prop (Fig. 18, 18*a*, 18*b*) to balance and keep the patient on an "even keel," as it were, in just the position the surgeon has secured for his patient, before beginning operation, and the one which he wishes maintained throughout.

There are few, if any, surgical postures where the patient and anæsthetist are mutually more taxed, to maintain satisfactory and safe respiration, than this, where the undermost lung is compressed from above by the superimposed body weight, and by some such form of lift as has already been described, bearing against the short ribs from below. Added to this, the free half of the thorax is weighed upon by the pendant arm and shoulder. Such a considerable drag in turn also tends to pull the trunk forward, rotating the spine on the pelvis, which is itself fixed vertically in place by adhesive-plaster guys to each side of the table. Any forward rotation of course interferes with

[1] This is made by the Kny-Scheerer Co. and the Hospital Supply Co., New York.

the best exposure of the kidney. While anæsthesia is being given, the detachable bar of the gallows is buckled to the arm on the same side as the surgical kidney, one strap each above and below the elbow. On lifting the patient to a side position on the operating table, the ring on this arm bar is hooked to the gallows, which is adjusted to the proper height to support the greater part of the weight of arm and shoulder, holding it free from the patient's side, thus favoring the fullest function for the superimposed lung, and at the same time preventing the patient's trunk from rotating forward.

The commendation of specialists in anæsthesia, who have used this device on our patients, corroborate our estimate of its importance, especially in heavy, flabby people.

FIG. 19.

FIG. 19. Individual postured for external urethrotomy or a modified prostatectomy on a small ironing table fitted with such portable assessories as the folding board, the kidney-and-liver-prop, the modified Clover's crutch and Clark and Roberts' neck yoke.

FIG. 19*a*.

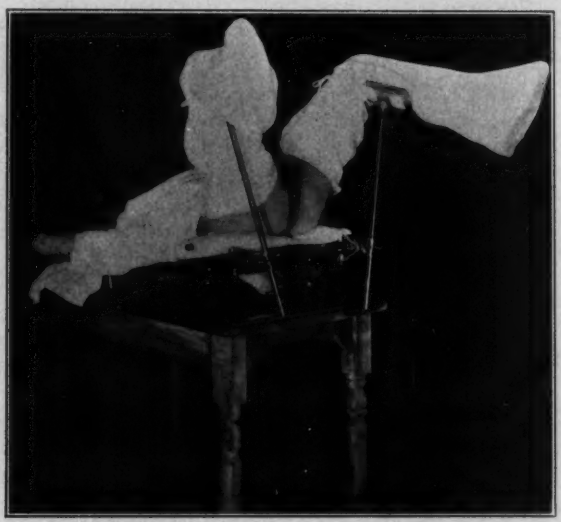

FIG. 19*b*.

FIG. 19*a*. Individual postured for the same, showing over the right shoulder one horn of the Clark and Roberts yoke, and the out-of-the-way position of the connecting bar of the author's Clover's leg crutch. When the services of an assistant,—for holding this bar so that the patient's pelvis is maintained in a perfectly horizontal position, as well as preventing him from rolling off the table,—are not available,—the same stability, as here shown, may be secured by the use of lateral guys from the crutch fastened to the table.

FIG. 19*b*.—Individual postured with portable appliances for cystoscopy and ureter catheterization.

This apparatus [1] is the outcome of having so frequently to delegate a nurse to the sole duty of supporting arm and shoulder in the case of patients evincing embarrassed respiration and a bad condition generally. The relief thus gained led to the regular practice of having such precautions taken, in all cases of kidney operations, from the moment the patient was in the side posture.

The tax on the person doing this support is a good index of the unheeded weight of this otherwise pendant extremity, and how easily such weight and drag on a patient's chest may cause respiratory embarrassment.

### THE OTIS EXAMINING CYSTOSCOPE AND A SLIGHT MODIFICATION

In Fig. 20B is shown one or two slight modifications in the excellent examining cystoscope (Fig. 20) of our late brother, Dr. W. K. Otis, in which the unique features are admirably combined and consist of a hemispherical lens in place of the older prism lens, the former giving a much larger visual field viewed through a generous fenestration in the concavity. This same large opening, when the telescope is out, serves to effect rapid irrigation and emptying of the bladder. Again, the instrument requires no obturator, and during introduction the lens of the telescope is turned away from the window, so that all chance of urethral smearing is out of the question. Another advantage of his cystoscope is its small circumference. Taken altogether, the Otis offers the best possible means for a rapid and successful examination in difficult cases, and where, without it, we would often hesitate to undertake cystoscopy at all unless the patient were under general anæsthesia. My modification, giving to the beak and shaft a rounded angle, in place of a sharp one, and providing for a water current to sweep over the lens, while in use, aim at supplying an occasional minor advantage.

If the elbow here connecting beak and shaft could be shortened so as to bring the lamp and lens closer together, the visual properties would be still better than at present (such an elbow has since been perfected; see Fig. 11).

This instrument is also exclusively made by the Wappler firm.

[1] Made by the Kny-Scheerer Co. and the Hospital Supply Co., New York.

FIG. 20.

FIG. 20.—(A) The Wm. K. Otis examining cystoscope. Features: A telescopic tube with a terminal hemispherical lens set in a revolving and readily removable telescope, securing, respectively, an unsoiled lens as soon as brought into the bladder and turned into the opening for use. An instrument also for rapid evacuating and cleansing of the bladder as soon as the telescope is drawn from the sheath.

(B) Brown's modification aims at adding to these major advantages another in the ease of introduction—by giving a rounded in place of pointed junction of a heel and shaft.

(See also Fig. 11, showing F. Tilden Brown's shorter lamp beak elbow there fitted to the author's modification of the Wm. K. Otis examining cystoscope).

## THE PORTABLE FOLDING BOARD

The portable folding board (Fig. 17A) is made of a couple of seven-eighths inch boards coupled together longitudinally by three heavy hinges, to permit folding for convenience in carrying. Each board is 34 inches long and 9½ inches wide. Affixed to the end of each is a small brass hinge; at the opposite extremity a buckle for inch webbing. Along the outer edges each board has a number of half-inch perforations. This opened board, supplemented by other and smaller portable parts, makes a fairly good substitute, in all pelvic operations, for the much heavier and cumbersome portable operating table. Excellent as is the latter, and while profiting by it in exceptional cases, we never assume this extra burden except from necessity. When we stop to consider just how much in this complete table is really essential, we see it resides mainly in the parts of the adjustable top, by which the surgeon is enabled to get about any degree of Trendelenburg posture, or the reverse. For nearly all such operations, carrying an entire table in order to secure the advantages of its adjustable and indispensable upper parts, is a waste of effort, since some sort of table or bench is to be found in every house to furnish the legs and lid to which our portable-small-parts can be affixed. On the other hand, it is not to be inferred that this lightly-built domestic table in itself can provide safe or adequate posturing for such operations merely by being raised at one end. Oftener than otherwise, even a strong table will not stand the strain of being tilted on two legs and bearing a person's weight. On the contrary, a much lighter, weaker table allowed to stand on its four legs, and having this portable folding board fastened to it at one end by the hinges (Figs. 19*a*, 19*b*, 19*c*), will be perfectly stable, and when this board is elevated at one end it gives us at once a reasonable Trendelenburg inclination.

One may ask, "Why take your own board? If you expect to find a suitable table, why are the chances not just as good for finding a suitable board?" Despite the presence of table leaves, box covers, and various other board substitutes, the chances are greatly against any of these serving the purpose of the portable folding board. The whole difference between

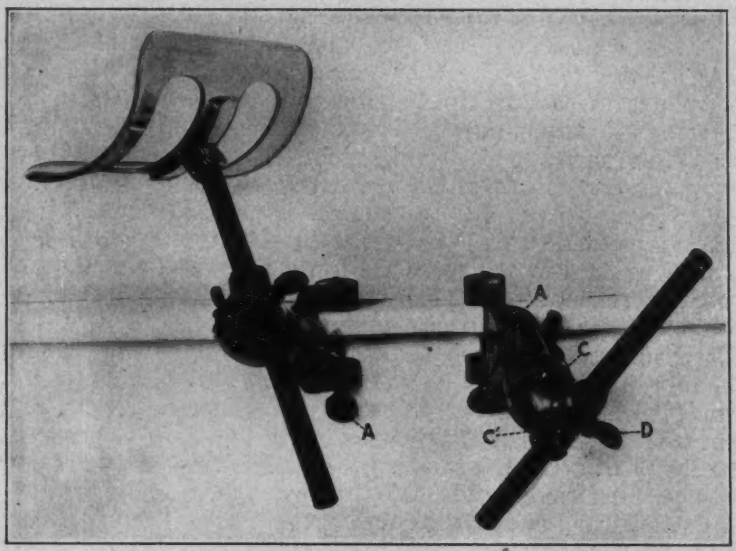


FIG. 21.

FIG. 21.—The author's portable clamps with serrated faces to hold the leg rests securely in any angle in any plane.

the one you find and that you take is, in the first place, the matter of length and size, and, secondly, the small but all-essential hinges which, when fastened to the table, will permit of extreme elevation without danger of slipping, whatever may be used for the prop; and besides, the board must be of the correct thickness to give good purchase to the clamps which may be needed for supporting the legs.

There are here some three-jointed clamps (Fig. 21) which permit of every desired position for the leg crutches. Like many of the other devices, this set is of aluminum, in order to reduce the total weight of the kit. Another aid in maintaining a special posture is the invaluable shoulder yoke (Fig. 17D), whereby, when it is clamped to the folding board at the proper place and the patient's scapulo clavicular region bears firmly against these two posts, any danger of the perineal region getting away from the edge of the board is prevented. When such a moderate lithotomy posture (Fig. 19 and 19*a*) is exaggerated to the one best for perineal prototectomy, the legs require an additional support to prevent over-abduction as well as an all-sufficient flexion and abduction. This is attained by my modification[1] of the Clover's crutch (Figs. 17F and 19). Instead of the straight bar running directly between the two padded leg bands there are here two long elbowed connections between these leg bands and the extensible longitudinal bar. By reason of this altered position of the long bar, urethral instruments can be inserted and removed without the former interference imposed by its faulty position in the original Clover's and besides this, the bar here rests on the patient's abdomen (Fig. 19*a*), the most favorable and out-of-the-way place for the nurse to hold it while steadying the patient. In all of these back positions, especially those where the body weight bears heavily upon the sacrum, some support under the lumbar region, to lessen this pressure, is important. To secure this, I have used for several years a kind of saddle-bag air cushion known as the "Phillips invalid cushion." The two bags are held together by a lacing which affords an adjustable groove for the spine.

[1] Made by George Tiemann and Co., N. Y.

## THE AUTHOR'S DUST-PROOF MICROSCOPE AND REAGENT CABINET FOR HOSPITAL WARD USE

THE need of a dust-proof cabinet (Figs. 22 and 22*a*) and always-ready-for-use microscopic outfit in general hospital wards, as an aid to hasty diagnosis, has been often enough experienced, to need no apology for presenting this table,[1] one of which has had six months' test in our genito-urinary ward at Bellevue Hospital where it has given satisfaction sufficient to lead us to feel that no essential alterations are required. These illustrations (Figs. 22 and 22*a*) of the cabinet, somewhat inaccurate, are enough to show the features and its manner of working.

Placed in an alcove-window, and with an electric-light plug at hand, daylight or the artificial can be utilized at any moment, to make examinations, since the microscope and its accessories stand ready for use on opening the case, as shown in Fig. 22*a*. Here, the front plate, which turns partly back upon the lid plate, serves now with its inner surface, as a shelf for bottles or substances to be examined. There is an all-metal compartment, running the length of the cabinet behind, having a door at each end from which the electric-light plug is taken according to the position of the fixture. This space serves as stowage for the microscope's wooden-case, sundries, and extra reagents, especially those to be kept from the light. All compartments to the cabinet are locked on closing the front lid.

It is believed, no matter how centrally situated or how perfectly equipped the hospital laboratory may be, that each ward should have some such individual outfit, whereby the interne staff can, in an emergency, or in the case of night work, be independent of a distant and deserted laboratory. While for clinical teaching by the attendant the immediate availability of such an aid is of moment.

[1] Made by the Hospital Supply Company, New York.

FIG. 22a.

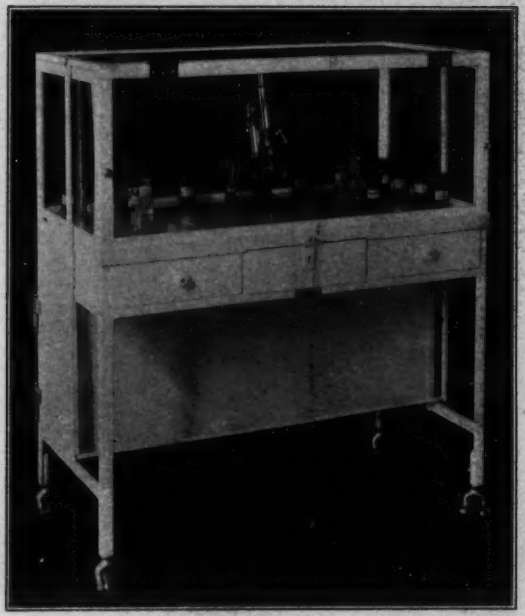

FIG. 22.

FIGS. 22 and 22a.—The author's dust-proof microscope and reagent cabinet for hospital ward use.